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Wildlife, Wetlands and Those "Other Plants"

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There are thousands of men and women whose job it is to venture into the wetlands and do work on behalf of the environment. Their job is to "manage" or "preserve" or "restore" swamps and woodlands, marshes and prairies, rivers and lakes, to promote biodiversity, and to encourage the growth of native plants and animals in an effort to preserve our ecosystems.

These "front-line" environmental field workers typically are the ones who take the soil and water samples, who count the plants and animals, and who use the herbicides and tractors. They are the ones who first notice when a single plant species is taking over, or when a duck species does not return the next year; they are the ones who report to the rest of us what's happening in the real world. Therefore, they need to know as much as possible about the wetlands they work in. These workers must know about the conspicuous invaders and the reclusive rarities, and also those "other plants" that are so important to the health and functioning of wetland ecosystems. They need to know about the grasses, sedges and rushes.

Grasses, sedges and rushes are often thought of, and frequently listed as "other plants" by workers in the "natural resource management" world. This is because grasses, sedges and rushes are difficult to identify, they don't get much press, and there are very many species.

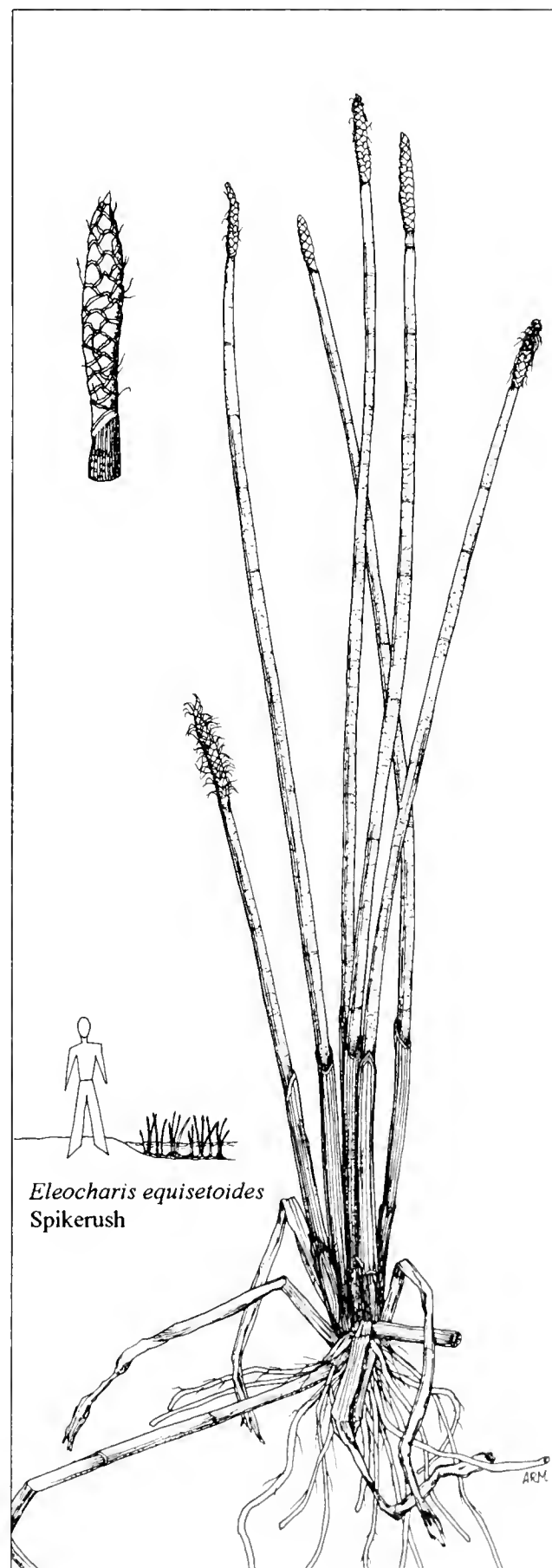
Even professional managers of wetlands, mostly non-botanists, often cannot tell a rush from a sedge or a beneficial native grass from an unchecked invader. This is actually very understandable. Nature managers must focus on "invasions" by hundreds of new species and are unable to pay attention to the "other plants". Consider also the "common name problem": short things are "sedges" (whether they are or not); tall things are "big grasses."

We could have a problem here.

One reason why managers should pay close attention to the grasses, sedges and rushes that grow in their marshes, lakes and rivers is that these plants are very important to the diets of many waterfowl such as ducks and geese. If the necessary grasses, sedges and rushes disappear from a wetland or lake or river, so could many of the kinds of birds and other animals that depend on them for food and shelter. Natural resource management personnel, especially field workers, must be able to recognize native and non-native grasses, sedges and rushes in order to control only the non-native invasive plants and to promote the growth of these native plants that wild animals depend on.

This article lists some of the published research about several of the specific grasses, sedges and rushes that are preferred foods of ducks, geese and other waterfowl. The research cited here was identified in the **APIRS** database of the University of Florida. Though this database is about aquatic, wetland and invasive plants, it naturally includes much information about the animals that use them.

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Eleocharis equisetoides
Spikerush

“Other Plants” - Continued from page 1

For the birds

Actually, it's *not* just for the birds. Research shows that the wild grasses, sedges and rushes of our wetlands are eaten and otherwise used by all kinds of animals including mammals as diverse as deer, rabbits, moose, cattle, alligators, beavers and boar. And, of course, birds.

Like other classes of animals, the birds include some species that are mostly vegetarian, some that are mostly carnivorous, and some that eat both plants and animals. Among the waterfowl, for example, wetland plant matter is very important to the diets of American widgeon, ring-necked ducks, redheads, gadwalls, mallards, pintails, wood ducks and canvasbacks; plant parts also are important to the diets of fulvous whistling ducks, green- and blue-winged teal, black ducks, spoonbill ducks, coots, moorhen, soras, Canada geese, snow geese, greylag geese, sandhill cranes, mourning doves, white-winged doves and other birds. Certain wetland grasses, sedges and rushes are also important as habitat and nesting materials. For example, American woodcocks have a special affinity for switch cane habitat (*Arundinaria gigantea*), and clapper rails prefer to nest in black needle rush (*Juncus roemerianus*) (46).

Management objectives

The literature shows that there are many issues that wetlands managers must deal with, such as development, pollution, recreational uses (“consumptive” uses such as hunting and “non-consumptive” uses such as tourism), and non-native species invasions. All of these challenges also affect the wetland’s populations of grasses, sedges and rushes, and the animals that depend on them.

“The first step to accomplishing the goal of marsh management for wildlife is to conduct a food habit study to determine if the best plants are growing in the marshes,” according to H.F. Percival. To help answer this question for a South Carolina wetland, researchers investigated the conditions necessary for the growth of important wildlife plants such as soil nutrition, soluble salts concentrations and water level (40).

It is surprising how much wildlife food is produced in an acre of productive wetland. In a 1951 study by J.R. Singleton of the east Texas gulf coast, researchers found that in a single acre, *Scirpus robustus* produced an average of about 300 lbs. (dry weight) of seeds per acre per year; *Echinochloa walteri* produced about 800 lbs. of seeds per acre, *Cladium jamaicense* and *Polygonum hydropiperoides* each produced about 600 lbs. of seeds per acre, *Leersia oryzoides* produced about 150 lbs. of seeds per acre, *Rhynchospora corniculata* produced about 900 lbs. of seeds per acre, and each acre produced about 5 tons of plant corms (44).

Among their other responsibilities, wetland resource managers must control non-native invasive plants, lest they take over a wetland and replace native wildlife food plants. For example, F.A. Johnson noted that in central Florida, the very invasive torpedograss (*Panicum repens*) can become “dense enough to discourage waterfowl use”. However, managers need to realize that when they are herbiciding, burning, chopping and otherwise controlling undesirable plants, they may also be killing very important grasses, sedges and rushes. According to Reid et al., “herbicide use has reduced grasses in the field” (46). When managers are controlling those familiar invaders



such as cat-tail (*Typha*), silk reed (*Neyraudia reynaudiana*), elephant grass (*Pennisetum purpurea*) and para grass (*Brachiaria mutica*), they should take care that their herbicides and flames are not also killing those unfamiliar “other plants.”

Food plants and birds

Birds are known to consume all parts of grasses, sedges and rushes, including tubers, rhizomes, stems, foliage, inflorescences and seeds. Therefore, work on the nutritional value and digestibility of wild plant parts has been conducted on *Scirpus americanus*, *Spartina* spp., *Juncus gerardi* and other grasses, sedges and rushes. (26).

In one unmatched study of mallard duck diets from 1918, W.L. McAtee reported collecting animals in 22 states and finding that mallards are mostly vegetarian, with more than 90% of their food being plant parts. Sedges (*Scirpus cubensis* and *Scirpus fluviatilis*), and *Fimbristylis*, *Cyperus* and *Cladium* comprised about a quarter of the mallard diet; with grasses (*Zizania aquatica*, *Echinochloa*, *Panicum* and *Spartina*) making up another 13%. The remainder of the mallard diet consisted of "smartweeds, 10%; pondweeds 8%; duckweeds 6%, coontail, 6%; wild celery 5%; sagittaria 5%; with the rest being acorns and berries" (30).

While some species of ducks eat more animals than plants, and some eat more plants than animals, for others the ratio depends on the habitat, food availability, and seasonality.

Seasonality in bird diets has been documented for several waterfowl species. Some kinds of ducks eat more animals during breeding/nesting season, and the same ones might prefer plant seeds during migration. For example, blue-winged teal change their diets seasonally, from eating aquatic invertebrates (such as gnats and small snails) in the breeding season, to eating mostly plant seeds during fall and winter (33). This may be due to the fact that animal foods provide more protein, possibly needed for egg development, etc., while plant seeds, rich in carbohydrates, provide more "quick energy" needed for flying.

In a study of gut contents of Wisconsin redhead ducks (*Aythya americana*), researchers found 34 animal species and 30 plant species. Seeds predominated in pre-laying birds; *Scirpus* seeds and *Potamogeton* tubers were the primary components of laying redheads (22).

Duck diets change not just seasonally, but also according to location and food availability. For example, a study found that canvasbacks in Louisiana ate lots of grasses, sedges and rushes (17), but in another study in Maryland they ate mostly widgeongrass (*Ruppia* spp.) and *Potamogeton perfoliatus* (41).

Redhead ducks are so-called "diving ducks", so one might presume that redheads eat only underwater plants and animals. However, a study in North Dakota found that as much as 30% of the redhead duck diet was plant material, most of which was *Scirpus* seeds (11%), and seeds from a variety of other emergent plants including *Eleocharis* and *Echinochloa*. In fact, overall, redhead ducks ate more emersed plant food than submersed plant food (48).

Grasses sedges and rushes are important foods even to very aquatic birds, such as the bottom-sifting shoal-water spoonbill duck (*Spatula clypeata*). In one study, 16% of the spoonbill diet was *Scirpus*, *Carex* and *Cladium*, 11% was *Potamogeton* and 8% was *Panicum* spp. (31).

The most important "staging area" for migrating greater snow geese (*Chen caerulescens*) is a 3750-ha *Scirpus americanus* marsh, where rhizomes, shoots and stems make up about half their entire diet during the several weeks of both migration seasons (5).

Coots (*Fulica atra*) also are major wetland plant consumers. In one study on a Polish lake, two-thirds of the coot diet was plant parts and one-third was animals. Even though coots spend much of their

time swimming and diving, the second-most important plant in the coot diet was *Phragmites australis* (after the bottom-growing *Chara* spp) (8).

Grow more grasses, sedges and rushes

In 1917, McAtee called for more dealers to grow and offer plants and seeds of various species of bur-reeds, pondweeds, cord grasses, bulrushes, saw grass, and sedges in order to supply wildlife managers who wanted to grow the right plants for birds (29).

In this booklet, McAtee tells managers how to propagate *Zizania aquatica* because wild rice, "in every stage of its growth is eaten by one or another of the North American ducks and geese, and practically all ducks feed on its ripened grain." It is "the staple fall food of many ducks in the numerous rice marshes of eastern U.S." This booklet also explains how to propagate chufas (*Cyperus esculentus*) and wild millet (*Echinochloa crus-galli*) (29).

Information abounds

Natural resource managers, including those workers who maintain and protect wetlands, lakes and rivers, should remember the importance of the "other plants" in their charge. Managers should learn about the grasses, sedges and rushes, and promote these and other plants that are essential to so many species of birds and other animals.

GRASSES, SEDGES AND RUSHES USED BY WATERFOWL --CITED RESEARCH ARTICLES

The following is a list of some of the feeding studies of water birds taken from the APIRS database:

Arundinaria gigantea stands -- a preferred habitat of American woodcock (Straw et al, (46))

Brachiaria extensa seeds -- a major part of the diet of fulvous whistling ducks in Louisiana ricefields. (20)

Carex spp. -- common snipe habitat (Arnold, (46))

Carex subspathacea -- a favorite food of geese (11)

Cladium jamaicense seeds -- very important to wintering gadwalls in Louisiana (39); a major food of ducks in SE Texas (44); a major food of mallards in the US (30)

Cyperus spp. -- a major part of the diet of fulvous whistling ducks in Louisiana (20); tubers are a major part of canvasback diet in Mississippi River Delta (17)

Distichlis spp. -- a food of sandhill cranes (46); among favorite food of gadwalls in Utah (13); eaten by mourning doves (46)

Echinochloa spp. -- eaten by mourning doves (46)

Echinochloa crus-galli -- a preferred food of pintail ducks in California (9), (10); a preferred food of green-winged teal (10); a major food of mallard ducks in the US (30)

Echinochloa walteri -- a major food of ducks in SE Texas (44)

Eleocharis spp. -- a favorite food of gadwalls in Utah (13), and of ruddy ducks (48)

Eleocharis cellulosa -- a major food plant of ducks in Texas (44)

Eleocharis equisetoides and *E. quadrangulata* -- important foods to overwintering waterfowl in South Carolina (40)

Eleocharis parvula -- leaves eaten by wintering gadwalls in Louisiana (39); a major food plant of ducks in Texas (44)

Eleocharis quadrangulata -- a major food of ducks in Texas (44)

Fimbristylis spp. -- a major food of mallard ducks (30)

Juncus roemerianus -- favored clapper rail nesting habitat (Eddleman and Conway, (46))

Leersia spp. -- a major part of diet in 3-year study of redhead ducks in Wisconsin. (22)

Panicum spp. -- preferred food of mourning doves and white-winged doves (46); a major food of mallard ducks (30)

Paspalum distichum -- used by greylag and barheaded geese (36)

Phalaris arundinea -- a major food of ring-necked ducks in Minnesota (16)

Phragmites communis -- a major plant food of coots in Poland (8)

Rhynchospora spp. -- a major food of fulvous whistling ducks in Louisiana (20)

Scirpus spp. -- a major component of the diet of ruddy ducks (48) and common moorhen (Grij, (46)), soras (Melvin and Gibbs, (46)), seeds very important to overwintering gadwalls in Louisiana, to redheads in Wisconsin (22); a major food of spoonbill ducks (31)

Scirpus acutus -- among favorite foods of gadwalls in Utah (13)

Scirpus americanus -- rhizomes and seeds a major part of diet in canvasbacks in the Mississippi River Delta (17)

Scirpus cubensis -- a major food of mallard ducks in US (30)

Scirpus fluviatilis -- a major food of mallard ducks in US (30)

Scirpus littoralis and *Scirpus maritimus* -- tubers eaten by wintering greylag geese in Spain (1)

Scirpus robustus and *Scirpus validus* -- important foods to overwintering birds in South Carolina. (40)

Scirpus subterminalis and *Scirpus torreyi* -- constituted 30% of the fall food diet of black ducks in Maine (34)

Setaria spp. -- preferred food of mourning doves and white-winged doves in southwestern U.S. (46)

Zizania aquatica -- "eaten by practically all ducks" (29); a favorite food of soras in upper midwest U.S. (Melvin and Gibbs, (46)); a major food of mallard ducks in U.S. (30); a major food of black ducks and wood ducks (29)

Bibliography

The following publications were identified by a search of the APIRS (aquatic, wetland and invasive plant) database, searching for information about the food preferences and consumption rates of waterfowl.

1) Amat, J.A. 1995. Effects of wintering greylag geese *Anser anser* on their *Scirpus* food plants. *Ecography* 18:155-163.

2) Belanger, L.; J.-F. Giroux and J. Bedard. 1990. Effects of goose grazing on the quality of *Scirpus americanus* rhizomes. *Can. J. Zool.* 68:1012-1014.

3) Belanger, L. and J. Bedard. 1994. Foraging ecology of greater snow geese, *Chen caerulescens atlantica*, in different *Scirpus* marsh plant communities. *Can. Field-Nat.* 108(3):271-281.

4) Belanger, L. and J. Bedard. 1994. Role of ice scouring and goose grubbing in marsh plant dynamics. *J. Ecol.* 82:437-445.

5) Belanger, L. and D. Lehoux. 1994. Use of a tidal saltmarsh and coastal impoundments by sympatric breeding and staging American black ducks, *Anas rubripes*, and mallards, *A. platyrhynchos*. *Can. Field-Nat.* 108(3):311-317.

6) Beltzer, A.H. and J.J. Neiff. Bird distribution in the Parana River floodplain. Relationship with hydrological regime and vegetation. *Ambiente Subtropical* 2:77-102. In Spanish; English summary.

7) Bogiatto, R.J. 1990. Fall and winter food habits of American coots in the northern Sacramento Valley, California. *Calif. Fish Game* 76(4):211-215.

8) Borowiec, E. 1975. Food of the coot (*Fulica atra* L.) in different phenological periods. *Pol. Arch. Hydrobiol.* 22(2):157-166.

9) Connelly, D.P. and D.L. Chesemore. 1980. Food habits of pintails, *Anas acuta*, wintering on seasonally flooded wetlands in the northern San Joaquin Valley, California. *Calif. Fish Game* 66(4):233-237.

10) Euliss, N.H. and S.W. Harris. 1987. Feeding ecology of northern pintails and green-winged teal wintering in California. *J. Wildl. Manage.* 51(4):724-732.

11) Gadallah, F.L. and R.L. Jefferies. 1995. Comparison of the nutrient contents of the principal forage plants utilized by lesser snow geese on summer breeding grounds. *J. Appl. Ecol.* 32(2):263-275.

12) Gadallah, F.L. and R.L. Jefferies. 1995. Forage quality in brood rearing areas of the lesser snow goose and the growth of captive goslings. *J. Appl. Ecol.* 32(2):276-287.

13) Gates, J.M. 1957. Autumn food habits of the gadwall in northern Utah. *Utah Acad. Proc.* 34:69-71.

14) Hartman, F.E. 1963. Estuarine wintering habitat for black ducks. *J. Wildl. Manage.* 27(3):339-347.

15) Hocutt, G.E. and R.W. Dimmick. 1971. Summer food habits of juvenile wood ducks in east Tennessee. *J. Wildl. Manage.* 35(2):286-292.

16) Hohman, W.L. 1985. Feeding ecology of ring-necked ducks in northwestern Minnesota. *J. Wildl. Manage.* 49(3):546-557.

17) Hohman, W.L.; D.W. Woolington and J.H. Devries. 1990. Food habits of wintering canvasbacks in Louisiana. *Can. J. Zool.* 68(12):2605-2609.

18) Hohman, W.L.; C.D. Ankney; and D.L. Roster. 1992. Body condition, food habits, and molt status of late-wintering ruddy ducks in California. *Southwestern Naturalist* 37(3):268-273.

19) Hohman, W.L. and C.D. Ankney. 1994. Body size and condition, age, plumage quality, and foods of prenesting male cinnamon teal in relation to pair status. *Can. J. Zool.* 72:2172-2176.

20) Hohman, W.L.; T.M. Stark and J.L. Moore. 1996. Food availability and feeding preferences of breeding fulvous whistling-ducks in Louisiana ricefields. *Wilson Bull.* 108(1):137-150.

21) Hudec, K. 1973. The food of the greylag goose, *Anser anser*, in southern Moravia, Czechoslovakia. *Zool. Listy* 22(1):41-58. In German.

22) Kenow, K.P. and D.H. Rusch. 1996. Food habits of redheads at the Horicon Marsh, Wisconsin. *J. Field Ornithol.* 67(4):649-659.

23) Kerekes, J.J. editor. 1994. Aquatic Birds in the Trophic Web of Lakes. Developments in Hydrobiology. Proceeding of a Symposium... Kluwer Academic Publishers, Dordrecht, The Netherlands. 524 pp.

24) Knapton, R.W. and K. Pauls. 1994. Fall food habits of American wigeon at Long Point, Lake Erie, Ontario. *J. Great Lakes Res.* 20(1):271-276.

25) Krapu, G.L. 1974. Foods of breeding pintails in North Dakota. *J. Wildl. Manage.* 38(3):408-417.

26) Krapu, G.L. and K.J. Reinecke. 1992. Foraging ecology and nutrition. IN: Ecology and Management of Breeding Waterfowl, B.D.J. Batt, et al., editors, Univ. Minnesota Press, Minneapolis, pp. 1-29.

27) Lemly, A.D. 1994. Irrigated agriculture and freshwater wetlands: a struggle for coexistence in the western United States. *Wetlands Ecol. Manage.* 3(1):3-15.

28) McAtee, W.L. 1915. Eleven important wild-duck foods. *Bull. U.S. Dept. Agric.* No. 205, Washington, D.C. 25 pp.

29) McAtee, W.L. 1917. Propagation of wild-duck foods. *Bull. U.S. Dept. Agric.* No. 465, Washington, D.C. 40 pp.

30) McAtee, W.L. 1918. Food habits of the mallard ducks of the United States. *Bull. U.S. Dept. Agric.*, No. 720, Washington, D.C. 36 pp.

31) McAtee, W.L. 1922. Notes on food habits of the shoveller or spoonbill duck (*Spatula clypeata*). *Auk* 39(3):380-386.

32) McAtee, W.L. 1925. Notes on drift, vegetable balls, and aquatic insects as a food product of inland waters. *Ecology* 6(3):288-302.

- 33) Manley, S.W.; W.L. Hohman; J.L. Moore; and D. Richard. 1992. Food preferences of spring-migrating blue-winged teal in southwestern Louisiana. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agenices* 46:46-56.
- 34) Mendall, H.L. 1949. Food habits in relation to black duck management in Maine. *J. Wildl. Manage.* 13(1):64-101.
- 35) Middleton, B.A. 1992. Seed herbivory by nilgai, feral cattle, and wild boar in the Keoladeo National Park, India. *Biotropica* 24(4):538-543.
- 36) Middleton, B.A. 1994. Management of monsoonal wetlands for greylag (*Anser anser* L.) and barheaded geese (*Anser indicus* L.) in the Keoladeo National Park, India. *Internat. J. Ecol. Environ. Sci.* 20:163-171.
- 37) Nummi, P. 1989. Simulated effects of the beaver on vegetation, invertebrates and ducks. *Ann. Zool. Fennici* 26:43-52.
- 38) Patten, B.C. editor. 1990. *Wetlands and Shallow Continental Water Bodies. Volume 1. Natural and Human Relationships.* SPB Academic Publishing, 759 pp.
- 39) Paulus, S.L. 1982. Feeding ecology of gadwalls in Louisiana in winter. *J. Wildl. Manage.* 46(1):71-79.
- 40) Percival, F.H.; L.G. Webb and N.R. Page. 1970. Some ecological conditions under which selected waterfowl food plants grow in South Carolina. *Proc. SE Assoc. Game & Fish Comm.* 24:121-126.
- 41) Perry, M.C. and F.M. Uhler. 1988. Food habits and distribution of wintering canvasbacks, *Aythya valisineria*, on Chesapeake Bay. *Estuaries* 11(1):57-67.
- 42) Ringelman, J.K. 1990. Managing agricultural foods for waterfowl. Fish Wildlife Leaflet 133.4.3. Waterfowl Management Handbook, Fish Wildlife Serv., U.S. Dept. Interior, Washington, D.C. 4 pp.
- 43) Ringelman, J.K. 1992. Ecology of montane wetlands. Fish Wildlife Leaflet 133.3.6. Waterfowl Management Handbook, Fish Wildlife Serv., U.S. Dept. Interior, Washington, D.C. 7 pp.
- 44) Singleton, J.R. 1951. Production and utilization of waterfowl food plants on the east Texas gulf coast. *J. Wildl. Manage.* 15(1):46-56.
- 45) Sjoberg, K.; K. Danell. 1981. Food availability and utilization by ducks of a shallow brackish-water bay in the northern Bothnian Bay. *Ann. Zool. Fennici* 18:253-261.
- 46) Tacha, T.C. and C.E. Braun, editors. 1994. *Migratory Shore and Upland Game Bird Management in North America.* International Association of Fish and Wildlife Agencies, Washington, D.C. 223 pp.
- 47) Verhoeven, J.T.A. 1980. The ecology of *Ruppia*-dominated communities in western Europe. III. Aspects of production, consumption and decomposition. *Aquat. Bot.* 8:209-253.
- 48) Woodin, M.C.; G.A. Swanson. 1989. Foods and dietary strategies of prairie-nesting ruddy ducks and redheads. *Condor* 91:280-297.
- 49) Weller, M.W. 1994. *Freshwater Marshes. Ecology and Wildlife Management.* U Minnesota Press, Minneapolis, 3rd ed. 155 pp.

Although the **APIRS** database collects literature on aquatic, wetland and invasive plants, this necessarily includes peripheral subjects such as animals which use these plants for food, habitat, nesting, etc. For example, the database contains over 1,000 references with the following keywords: (*duck* or *ducks* or *birds* or *waterfowl* or *avian* or *geese* or *goose*). (NOTE: if you use *duck*\$, you will retrieve a few hundred duckweed articles that don't necessarily pertain to ducks.) If you combine this search with (*food*\$ or *feed*\$ or *diet*\$ or *consum*\$ or *graz*\$ or *herbiv*\$), you will retrieve over 300 references. With (*habitat* or *host plant*\$ or *nest*\$ or *breed*\$) - over 680 references. With (*primary production*) or *productivity*) - over 180 references that might report on the effects of herbivory on productivity, or the effects of productivity on bird habitat, foods, etc.



Juncus effusus
Soft rush

Books/Reports

IN SEARCH OF SWAMP- LAND -- A WETLAND SOURCEBOOK AND FIELD GUIDE, by R.W. Tiner. 1998. 265 pp.

(Order from Rutgers University Press, 100 Joyce Kilmer Avenue, Piscataway, NJ 08854-8099. \$26.00 paper; \$55.00 cloth, plus S/H. 1-800-446-9323.)

This is another general introduction to wetlands that includes an overview of wetland ecology, and a "wetland identification guide" to plants, soils, animals and delineation. The book includes descriptions and drawings of more than 300 plants and 200 animals.

AQUATIC PLANTS IN BRIT- AIN AND IRELAND, by C.D. Preston and J.M. Croft. 1997. 365 pp.

(Order from Harley Books, Martins, Great Horkesley, Colchester, Essex CO6 4AH, ENGLAND. £25, net.)

The Chairman of the Environment Agency states in the forward, "...This volume presents, for the first time, a thorough review of all freshwater plants in Britain and Ireland. It is both an atlas of distribution and compendium of scientific information." The book summarizes the distribution, habitat and reproductive biology of 200 taxa in 72 genera, including distribution maps for Britain and Ireland. The book includes a single line drawing for each genus, and no photographs.

SEAGRASS BIOLOGY -- PROCEEDINGS OF AN IN- TERNATIONAL WORK- SHOP, Volumes 1 and 2, edited by J. Kuo, R.C. Phillips, D.I. Walker and H. Kirkman. 1996. Two hardcover vol- umes: 385 pp. and 276 pp.

(Order from John Kuo, CMM. University of Western Australia, Nedlands 6907, AUSTRALIA. E-mail: jjskuo@cyllene.uwa.edu.au US\$80 plus US\$30 postage.)

A 1996 statement from 65 of the world's leading seagrass scientists calls attention to

the fact that seagrass habitat is declining world-wide, especially because of coastal development and watershed runoff, and that seagrass loss will reduce fisheries production, water quality, sediment stability and biodiversity. According to C. Peter McRoy, "unlike many other marine ecosystems, seagrasses may be amenable to management, if management practices are based on knowledge of plant biology and ecosystem interactions."

These are the proceedings and discussions of an international workshop held at Rottnest Island, Western Australia, 25-29 January 1996. Volume 1 contains 49 peer-reviewed papers on diversity and plant biology, molecular genetics, hydrodynamics, production and nutrient dynamics, animal interactions, decline and recovery, and monitoring and management. Volume 2 presents the transcripts of scientific discussions from each of the presented papers.

FRESHWATER ALGAE IN AUSTRALIA -- A Guide To Conspicuous Genera, by T.J. Entwistle, J.A. Sonneman, and S.H. Lewis. 1997. 242 pp.

(Order from Sainty and Associates Pty. Ltd., POB 1219, Potts Point, NSW 2011, Australia. E-mail: geoff@sainty.com.au OR WWW: <http://www.sainty.com.au> \$A36.95 soft cover; \$A49.95 hard cover, plus S/H.)

This is a beautifully organized and illustrated manual about 96 species of algae from Australia. The schematic keys are based on the most readily observable characters. The color micrographs and printing are exceptional for such a relatively inexpensive book. Each genus is described in terms of habitat and habit, color and microscopic features, species and distribution.

RIVER HABITAT QUALITY -- THE PHYSICAL CHARAC- TER OF RIVERS AND STREAMS IN THE UK AND ISLE OF MAN, by P.J. Raven, N.T.H. Holmes, F.H. Dawson, P.J.A. Fox, M. Everard, I.R. Fozzard, and K.J. Rouen. 1998. 90 pp.

(Order from Environment Agency, Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol BS32 4UD, England. Or download it from <http://www.environment-agency.gov.uk/info/riverhq.html>)

This report "describes a method for evaluating the physical character of rivers." It also summarizes the results of the first ever baseline survey of river habitats in the United Kingdom. It is illustrated with photographs, drawings, graphs, charts and maps, and includes a pullout "summary fact-sheet".

WICKEN FEN -- THE MAK- ING OF A WETLAND NA- TURE RESERVE, edited by Laurie Friday. 1997. 306 pp.

(Order from Harley Books, Martins, Great Horkesley, Colchester, Essex CO6 4AH, England. £24.50 paper; £37.50 cloth, plus S/H.)

Wicken Fen, 305 hectares of mire, was established as a "reserve" in 1899 in order to help protect what was left of England's almost 4,000 sq. km. of Fenlands. There are four such reserves, however, "Only at Wicken Fen is there a feeling of continuity with the past...where the fenmen unwittingly conserved so many of the plants and animals of the untamed fen: at Wicken Fen the reeds and sedge are still cut."

This book is in four parts: an introduction to fenlands; habitats and communities remaining at the fenland reserves; flora and fauna of the fens; and "the human dimension": the history, management and future of the fens. Included with the several excellent essays about the plants, animals and human uses of the fens are many photos, drawings and lists.

THE PANTANAL OF POCONÉ -- Biota and Ecology in the Northern Section of the World's Largest Pristine Wet- land, Monographiae Biologicae 77, by C.W. Heckman. 1998. 622 pp.

(Order from Kluwer Academic Publishers, Order Dept. POB 322, 3300 AH Dordrecht, The Netherlands. E-mail: services@wkap.nl \$US285.00.)

The huge and isolated Pantanal of Poconé is believed to be the world's largest wetland "that is still in a nearly natural state". This impressive compendium is the most comprehensive source of information about all natural aspects of the Pantanal. Found in the "tropical wet-and-dry climatic zone" in the center of South America, the Pantanal covers about 200,000 sq. km., with a catchment area of nearly 1/2 million sq. km. Until the 1990s, little ecologic study of the Pantanal had been undertaken. This book includes observations of the author during the course of several years in the field as well as reviews of existing published research, and includes sections about geography, geology, climate, hydrology, water chemistry, flora, fauna, biotic communities, seasonal succession, ecosystem dynamics, human impact, and conservation of the Pantanal. The publisher states that this book "is meant to be a basic sourcebook of tropical ecology and wetland biology."

WHAT IS NATURAL? CORAL REEF CRISIS, by J. Sapp. 1999. 275 pp.

(Order from Oxford University Press, 198 Madison Avenue, New York, New York 10016-4314; WWW: <http://www.oup-usa.org> ISBN: 019-512364-6; \$30.00)

For the past 30 years, huge (2 ft. diameter) crown-of-thorns starfish have been infesting coral reefs around the world, "leaving in their wake devastation comparable to a burnt-out rainforest." The continuing plagues have been blamed on everything from nuclear testing to pesticide use to El Niño. This story "offers a window from which to examine environmentalism and its relations with marine ecology and governments."

HYDROLOGY OF CENTRAL FLORIDA LAKES -- A PRIMER, by D.M. Schiffer. 1998. 38 pp.

(Order from U.S. Geological Survey, Branch of Information Services, Box 25286, Denver, CO 80225-0286. Circular 1 free on written request.)

This very good, easy-to-read, colorful, large-format booklet introduces citizens to

the lakes of central Florida. Answering many of the basic questions people have, it explains lake classification, the hydrologic cycle, the geology of central Florida, the causes of lake water-level fluctuations, and water quality.

TECHNICAL EVALUATION OF MONITORING METHODS USING MACROPHYTES, PHYTOPLANKTON AND PERIPHYTON TO ASSESS THE IMPACTS OF MINE EFFLUENTS ON THE AQUATIC ENVIRONMENT, by L. St-Cyr, A. Cattaneo, R. Chasse and C.G.J. Fraikin. 1998. 200 pp.

(Order from CANMET, 555 Booth Street, Ottawa, Ontario, Canada K1A 0G1.)

This technical report on biomonitoring methods was prepared for the Aquatic Effects Technology Evaluation Program and the Canadian Center for Mineral and Energy Technology. The report reviews published literature about "established and emerging monitoring methods using macrophytes, phytoplankton and periphyton, and makes recommendations as to the usefulness and cost-effectiveness of these methods."

BIOLOGICAL ASPECTS OF *SCENEDESMUS* (CHLOROPHYCEAE) - PHE- NOTYPIC PLASTICITY, by F.R. Trainor. 1998. 367 pp.

(Order from Gebrüder Borntraeger, Verlagsbuchhandlung, Johannesstr. 3A, D-70176 Stuttgart, Germany; E-mail: order@schweizerbart.de Nova Hedwigia, Beiheft 117, US\$72.00)

The question posed: Is *Scenedesmus*, a freshwater green colonial algae, a single extremely "plastic" (polymorphic) taxa, or is it hundreds of species and taxa? The problem is that *Scenedesmus* has so many growth forms that have been described during the past 175 years that it is necessary to write a book to support the idea that it is taxonomically-okay that the taxa has many, many "ecomorphs". Some growth forms may even

be triggered by "infochemicals" released by algal predators in the local environment.

CONSTRUCTED WET- LANDS FOR WASTEWATER TREATMENT IN EUROPE, edited by J. Vymazal, H. Brix, P.F. Cooper, M.B. Green and R. Haberl. 1998. 366 pp.

(Order from Backhuys Publishers, POB 321, 2300 AH Leiden, The Netherlands; E-mail: backhuys@euronet.nl WWW: <http://www.euronet.nl/users/backhuys/> US\$139.00, hardbound.)

This is a complete and readable history of wetland/wastewater technology in Europe, from the 1950s German experiments of Kathe Seidel to present work in Austria, Portugal, Norway and elsewhere. Experiences and case studies from 15 countries are described, including the types of constructed wetlands, main design parameters, treatment efficiency, construction, maintenance and operation, costs, operational problems and current research.

INVASIVE PLANTS--WEEDS OF THE GLOBAL GARDEN, edited by J.M. Randall and J. Marinelli. Brooklyn Botanic Garden, Handbook #149. 1996. 111 pp.

(Order from Brooklyn Botanic Garden, 1000 Washington Ave, Brooklyn, NY 11225-2097. (718)-622-4433, Ext. 274. \$9.95 plus S/H.)

This very good little book includes two succinct and understandable introductions by the editors: Redefining the Weed, and How Non-Native Species Invade and Degrade Natural Areas. The book includes one section on "chemical-free weed controls" and another on choosing and applying herbicides when necessary. The remainder includes the "encyclopedia of invasive plants" with trees, shrubs, annuals, perennials, grasses, vines and aquatic plants, 76 species in all. Each plant treatment includes, in plain English, what does it look like? where did it come from? where has it spread? what problems does it cause? how can it be controlled? Color plant portraits, though small, are included.

FROM THE DATABASE

Here is a sampling of the research articles, books and reports which have been entered into the aquatic plant database since January 1998.

The database has more than 48,000 citations. To receive free bibliographies on specific plants and/or subjects, contact APIRS using the information on the back page or use the database online at <http://aquat1.ifas.ufl.edu/>

To obtain articles, contact your nearest state or university library.

Alam, M.K., Ager, L.A., Rosegger, T.M., Lange, T.R., et al

Effects of mechanical harvesting of floating plant communities on water quality in Lake Istokpoga, Florida.

IN: 1998 PROC. 23RD ANN. CONF. ECOSYSTEMS RESTORATION AND CREATION, HILLSBOROUGH COMMUNITY COLLEGE, TAMPA, FL, P.J. CANNIZZARO, ED., PP. 171-186. 1998.

Bachmann, R.W., Hoyer, M.V., Canfield, D.E.

Fluid mud, the marsh flow-way and the restoration of Lake Apopka.

IN: PROC. SEVENTH ANN. SE LAKES MGMT. CONF., 15-18 APRIL 1998, ORLANDO, FL, S.H. DARLING, H.H. HARPER, EDS., PP. A99-100 (ABSTRACT). 1998.

Baird, R.A., Jackson, B.

The use of alum to restore Class III water quality standards in highly urbanized lakes.

IN: PROC. SEVENTH ANN. SE LAKES MGMT. CONF., 15-18 APRIL 1998, ORLANDO, FL, S.H. DARLING, H.H. HARPER, EDS., PP. A141-142 (ABSTRACT). 1998.

Barbour, J.G., Kiviat, E.

Introduced purple loosestrife as host of native Saturniidae (Lepidoptera).

GREAT LAKES ENTOMOLOGIST 30(3):115-122. 1997.

Barrett, P.R.F., Littlejohn, J.W., Curnow, J.

The long-term control of diatom and cyanobacterial blooms in reservoirs using barley straw.

IN: PROC. 10TH EWRS INTERNAT'L. SYMP. AQUATIC WEEDS, EUROPEAN WEED RESEARCH SOC., 21-25 SEPTEMBER 1998, LISBON, PP. 311-314. 1998.

Bellando, M., Sacco, S., Albergoni, F., Rocco, P., et al

Transient stimulation of oxygen uptake induced by sulfhydryl reagents in *Egeria densa* and *Potamogeton crispus* leaves.

BOT. ACTA 110(5):388-394. 1997.

Bentivegna, D.J., Sabbatini, M.R., Curvetto, N.R., Fernandez, O.A.

Effect of acrolein on *Potamogeton pectinatus* L. in irrigation channels.

IN: PROC. 10TH EWRS INTERNAT'L. SYMP. AQUATIC

WEEDS, EUROPEAN WEED RESEARCH SOC., 21-25 SEPTEMBER 1998, LISBON, PP. 319-322. 1998.

Blanch, S.J., Ganf, G.G., Walker, K.F.

Growth and recruitment in *Vallisneria americana* as related to average irradiance in the water column.

AQUATIC BOTANY 61:181-205. 1998.

Bliss, S.A., Zedler, P.H.

The germination process in vernal pools: sensitivity to environmental conditions and effects on community structure.

OECOLOGIA 113(1):67-73. 1998.

Boeger, M.R.

Comparative study of the lacunar systems of *Eichhornia crassipes* (Mart.) Solms. and *Pistia stratiotes* L.

ARQ. BIOL. TECHNOL. 40(4):915-925 (IN PORTUGUESE; ENGLISH SUMMARY). 1997.

Boeye, D., Verhagen, B., Van Haesebroeck, V., Verheyen, R.F.

Nutrient limitation in species-rich lowland fens.

J. VEGETATION SCI. 8:415-424. 1997.

Bona, C., Lange de Morretes, B.

Comparative stem anatomy of *Alternanthera philoxeroides* (Mart.) Griseb. and *A. aquatica* (Parodi) Chodat. (Amaranthaceae).

ARQ. DE BIOLOGIA E TECNOLOGIA 40(2):285-296 (IN PORTUGUESE; ENGLISH SUMMARY). 1997.

Bonifacio, R.S., Montano, M.N.E.

Inhibitory effects of mercury and cadmium on seed germination of *Enhalus acoroides* (L.f.) Royle.

BULL. ENVIRON. CONTAM. TOXICOL. 60(1):45-51. 1998.

Bontje, M.P.

The establishment of recovery thresholds in a petroleum impacted tidal marsh.

IN: 1998 PROC. 23RD ANN. CONF. ECOSYSTEMS RESTORATION AND CREATION, HILLSBOROUGH COMMUNITY COLLEGE, TAMPA, FL, P.J. CANNIZZARO, ED., PP. 1-12. 1998.

Boyer, K.E., Zedler, J.B.

Effects of nitrogen additions on the vertical

structure of a constructed cordgrass marsh. ECOLOGICAL APPLICATIONS 8(3):692-705. 1998.

Brewer, J.S., Levine, J.M., Bertness, M.D.

Effects of biomass removal and elevation on species richness in a New England salt marsh.

OIKOS 80:333-341. 1997.

Brock, M.A., Casanova, M.T.

Plant life at the edge of wetlands: ecological responses to wetting and drying patterns.

IN: FRONTIERS IN ECOLOGY: BUILDING THE LINKS, N. KLOMP, I. LUNT, EDS., ELSEVIER SCI., OXFORD, PP. 181-192. 1997.

Brown, K.M.

Temporal and spatial patterns of abundance in the gastropod assemblage of a macrophyte bed.

AMER. MALACOLOGICAL BULL. 14(1):27-33. 1997.

Browning, J., Gordon-Gray, K.D., Smith, S.G., Van Staden, J.

Bolboschoenus maritimus s.l. in The Netherlands: A study of pericarp anatomy based on the work of Irene Robertus-Koster.

ANN. BOT. FENNICI 34:115-126. 1997.

Brunton, D.F., Britton, D.M.

Appalachian quillwort (*Isoetes appalachiana*, sp. nov.; Isoetaceae), a new pteridophyte from the eastern United States.

RHODORA 99(898):118-133. 1997.

Buckingham, G.R.

Surveys for insects that feed on Eurasian watermilfoil, *Myriophyllum spicatum*, and hydrilla, *Hydrilla verticillata*, in the People's Republic of China, Japan, and Korea. TECH. REPT. A-98-5, AQUATIC PLANT CONTROL RES. PROG., WATERWAYS EXPT. STN., U.S. ARMY CORPS OF ENGINEERS, VICKSBURG, MS, 36 PP. 1998.

Bunting, M.J., Duthie, H.C., Campbell, D.R., Warner, B.G., et al

A palaeoecological record of recent environmental change at Big Creek Marsh, Long Point, Lake Erie.

J. GREAT LAKES RES. 23(3):349-368. 1997.

Busch, D.E., Loftus, W.F., Bass, O.L.

Long-term hydrologic effects on marsh plant community structure in the southern Everglades.

WETLANDS 18(2):230-241. 1998.

Carbonell, A.A., Aarabi, M.A., DeLaune, R.D., Gambrell, R.P., et al
Arsenic in wetland vegetation: availability, phytotoxicity, uptake and effects on plant growth and nutrition.

SCI. TOTAL ENVIRON. 217:189-199. 1998.

Christensen, K.K., Andersen, F.O., Jensen, H.S.

Comparison of iron, manganese, and phosphorus retention in freshwater littoral sediment with growth of *Littorella uniflora* and benthic microalgae.

BIOGEOCHEM. 38:149-171. 1997.

Cilliers, C.J.

First attempt at the biological control of the weed, *Myriophyllum aquaticum*, in South Africa.

IN: PROC. 10TH EWRS INTERNAT'L. SYMP. AQUATIC WEEDS, EUROPEAN WEED RESEARCH SOC., 21-25 SEPTEMBER 1998, LISBON, PP. 331-334. 1998.

Davis, R.C., Short, F.T.

Restoring eelgrass, *Zostera marina* L., habitat using a new transplanting technique: the horizontal rhizome method.

AQUATIC BOTANY 59:1-15. 1997.

Dean, T.A., Stekoll, M.S., Jewett, S.C., Smith, R.O., et al

Eelgrass (*Zostera marina* L.) in Prince William Sound, Alaska: effects of the Exxon Valdez oil spill.

MARINE POLL. BULL. 36(3):201-210. 1998.

Doud, C.W., Wilson, S.W., Tsai, J.H.

Descriptions of nymphs of the cat-tail feeding Delphacid planthopper *Pygospina spinata* (Homoptera: Fulgoroidea).

FLORIDA ENTOMOLOGIST 80(4):443-450. 1997.

Duncan, T.M., Renzaglia, K.S., Gargary, D.J.

Ultrastructure and phylogeny of the spermatozoid of *Chara vulgaris* (Charophyceae).

PL. SYST. EVOL. 204:125-140. 1997.

Erwin, K.L., Doherty, S.J., Brown, M.T., Best, G.R., eds.

Evaluation of constructed wetlands on phosphate mined lands in Florida - Vol. I, Project Summary. Vol. II, Hydrology, Soils, Water Quality, and Aquatic Fauna. Vol. III, Vegetation, Wildlife, and Ecosystem and Landscape Organization.

FLORIDA INST. PHOSPHATE RESEARCH (FIPR) PUBL. NO. 03-103-139, BARTOW, FL. 1997.

Fell, P.E., Weissbach, S.P., Jones, D.A., Fallon, M.A., et al

Does invasion of oligohaline tidal marshes by reed grass, *Phragmites australis* (Cav.) Trin. ex Steud., affect the availability of prey resources for the mummichog, *Fundulus heteroclitus* L.?

J. EXP. MAR. BIOL. ECOL. 222:59-77. 1998.

Frazier, K., Colvin, B., Styer, E., Hullinger, G., et al

Microcystin toxicosis in cattle due to overgrowth of blue-green algae.

VETERINARY AND HUMAN TOXICOL. 40(1):23-24. 1998.

Guimaraes, J.R.D., Meili, M., Malm, O., de Souza Brito, E.M.

Hg methylation in sediments and floating meadows of a tropical lake in the Pantanal floodplain, Brazil.

SCI. TOTAL ENVIRON. 213:165-175. 1998.

Hargis, F.

Use of the exotic plant *Oenanthe javanica* in plant/rock filters for on-site wastewater disposal.

ENVIRONMENTAL HEALTH 60(10):18-25. 1998.

Hill, D.T., Payne, V.W.E., Rogers, J.W., Kown, S.R.

Ammonia effects on the biomass production of five constructed wetland plant species.

BIORESOURCE TECH. 62(3):109-113. 1997.

Hollingsworth, P.M., Preston, C.D., Gornall, R.J.

Euploid and aneuploid evolution in *Potamogeton* (Potamogetonaceae): a factual basis for interpretation.

AQUATIC BOTANY 60:337-358. 1998.

Hafez, N., Abdalla, S., Ramadan, Y.S.

Accumulation of phenol by *Potamogeton crispus* from aqueous industrial waste.

BULL. ENVIRON. CONTAM. TOXICOL. 60:944-948. 1998.

Janauer, G.A.

Macrophytes, hydrology, and aquatic ecotones: a GIS-supported ecological survey.

AQUATIC BOTANY 58:379-391. 1997.

Kalmbacher, R., Mullahey, J., Hill, K.

Limpogras and *Hymenachne* grown on flatwoods range pond margins.

J. RANGE MANAGE. 51:282-287. 1998.

Keeley, J.E.

C4 photosynthetic modifications in the evolutionary transition from land to water in aquatic grasses.

OECOLOGIA 116:85-97. 1998.

Killgore, K.J., Kirk, J.P., Foltz, J.W.

Response of littoral fishes in upper Lake Marion, South Carolina following hydrilla control by triploid grass carp.

J. AQUAT. PLANT MANAGE. 36:82-87. 1998.

Kim, B.J., Smith, E.D.

Evaluation of sludge dewatering reed beds: a niche for small systems.

WAT. SCI. TECH. 35(6):21-28. 1997.

Kinlan, B., Duffy, E., Cebrian, J., Hauxwell, J., et al

Control of periphyton on *Zostera marina* by the eastern mudsnail, *Ilyanassa obsoleta* (Say), in a shallow temperate estuary.

BIOL. BULL. 193:286-287. 1997.

Kivaisi, A.K., Mtila, M.

Production of biogas from water hyacinth (*Eichhornia crassipes*) (Mart) (Solms) in a two-stage bioreactor.

WORLD J. MICROBIOL. BIOTECH. 14(1):125-131. 1998.

Kolesik, P., Mills, A., Sedgley, M.

Anatomical characteristics affecting the musical performance of clarinet reeds made from *Arundo donax* L. (Gramineae).

ANNALS OF BOTANY 81(1):151-155. 1998.

Krolikowska, J.

Eutrophication processes in a shallow, macrophyte-dominated lake -- species differentiation, biomass and the distribution of submerged macrophytes in Lake Luknajno (Poland).

HYDROBIOLOGIA 342/343:411-416. 1997.

Kudoh, H., Whigham, D.F.

Microgeographic genetic structure and gene flow in *Hibiscus moscheutos* (Malvaceae) populations.

AMER. J. BOT. 84(9):1285-1293. 1997.

Lane, A.M., Williams, R.J., Muller, W.J., Lonsdale, W.M.

The effects of the herbicide tebuthiuron on seedlings of *Mimosa pigra* and native floodplain vegetation in northern Australia.

AUSTRALIAN J. ECOL. 22:439-447. 1997.

Leitch, J.A., Linz, G.M., Baltezare, J.F.
Economics of cattail (*Typha* spp.) control to reduce blackbird damage to sunflower. AGRICULTURE, ECOSYSTEMS AND ENVIRON. 65:141-149. 1997.

Lembi, C.A.

A message to our public: why aquatic herbicides affect aquatic plants and not us. IN: AQUATIC PLANT MANAGE. SOC., 38TH ANN. MEETING, 12-15 JULY 1998, MEMPHIS, TN, P. 2 (ABSTRACT). 1998.

Lemon, G.D., Posluszny, U.

Shoot morphology and organogenesis of the aquatic floating fern *Salvinia molesta* D.S. Mitchell, examined with the aid of laser scanning confocal microscopy. INTERNAT'L. J. PLANT SCI. 158(6):693-703. 1997.

Leon, B., Young, K.R.

Aquatic plants of Peru: diversity, distribution and conservation. BIODIVERSITY AND CONSERVATION 5:1169-1190. 1996.

Leonard, V., Breyne, C., Micha, J-C., Larondelle, Y.

Digestibility and transit time of *Azolla filiculoides* Lamarch in *Oreochromis aureus* (Steindachner). AQUACULTURE RESEARCH 29:159-165. 1998.

Les, D.H., Landolt, E., Crawford, D.J.
Systematics of the Lemnaceae (Duckweeds): inferences from micromolecular and morphological data. PL. SYST. EVOL. 204:161-177. 1997.

Lewis, M.A., Wang, W.

Water quality and aquatic plants. IN: PLANTS FOR ENVIRONMENTAL STUDIES, W. WANG, J.W. GORSUCH, J.S. HUGHES, EDS., CRC LEWIS PUBLISHERS, NEW YORK, PP. 141-175. 1997.

Lindgren, C.J., Gabor, T.S., Murkin, H.R.

Impact of triclopyr amine on *Galerucella californiensis* L. (Coleoptera: Chrysomelidae) and a step toward integrated management of purple loosestrife *Lythrum salicaria* L. BIOLOGICAL CONTROL 12:14-19. 1998.

Madden, C.J., Kemp, W.M.

Ecosystem model of an estuarine submersed plant community: calibration and simulation of eutrophication responses. ESTUARIES 19(2B):457-474. 1996.

Manyin, T., Williams, F.M., Stark, L.R.
Effects of iron concentration and flow rate on treatment of coal mine drainage in

wetland mesocosms: an experimental approach to sizing of constructed wetlands.

ECOL. ENGINEERING 9(3-4):171-185. 1997.

McCarron, J.K., McLeod, K.W., Conner, W.H.

Flood and salinity stress of wetland woody species, buttonbush (*Cephalanthus occidentalis*) and swamp tupelo (*Nyssa sylvatica* var. *biflora*). WETLANDS 18(2):165-175. 1998.

Monteiro, A., Vasconcelos, T., Catarino, L., eds.

Management and ecology of aquatic plants. PROC. 10TH EWRS INTERNAT'L. SYMP. AQUATIC WEEDS, EUROPEAN WEED RESEARCH SOC., 21-25 SEPTEMBER 1998, LISBON, 444 PP.

Morris, J.T., Jensen, A.

The carbon balance of grazed and non-grazed *Spartina anglica* saltmarshes at Skallingen, Denmark. J. ECOL. 86:229-242. 1998.

Moteetee, A., Nagendran, C.R.

Comparative anatomical studies in five southern African species of *Crassula*: II. Structure of the leaf and the occurrence of transfer cells. SOUTH AFRICAN J. BOT. 63(2):95-99. 1997.

Muenchow, G.E.

Subandrodioecy and male fitness in *Sagittaria lancifolia* subsp. *lancifolia* (Alismataceae). AMER. J. BOT. 85(4):513-520. 1998.

Mumby, P.J., Green, E.P., Edwards, A.J., Clark, C.D.

Measurement of seagrass standing crop using satellite and digital airborne remote sensing. MARINE ECOL. PROG. SER. 159:51-60. 1997.

Neely, R.K., Wetzel, R.G.

Autumnal production by bacteria and autotrophs attached to *Typha latifolia* L. detritus. J. FRESHWATER ECOL. 12(2):253-267. 1997.

Netherland, M.D., Sisneros, D., Fox, A.M., Haller, W.T.

Field evaluation of low-dose metering and polymer endothall applications and comparison of fluridone degradation from liquid and slow-release pellet applications.

TECH. REPT. A-98-2, AQUATIC PLANT CONTROL RES. PROG., U.S. ARMY CORPS OF ENGINEERS, WATERWAYS EXPT. STN., VICKSBURG, MS, 55 PP. 1998.

Newman, S., Schuette, J., Grace, J.B., Rutchey, K., et al

Factors influencing cattail abundance in the northern Everglades. AQUATIC BOTANY 60:265-280. 1998.

Nohara, S., Kimura, M.

Growth characteristics of *Nelumbo nucifera* Gaertn. in response to water depth and flooding. ECOL. RESEARCH 12:11-20. 1997.

Norris, J.G., Wyllie-Echeverria, S.

Estimating maximum depth distribution of seagrass using underwater videography. IN: PROC. FOURTH INTERNAT'L. CONF., REMOTE SENSING FOR MARINE AND COASTAL ENVIRONMENTS: TECHNOLOGY AND APPLICATIONS, ORLANDO, FLORIDA, 17-19 MARCH 1997, 8 PP. 1997.

Notzold, R., Blossey, B., Newton, E.

The influence of below ground herbivory and plant competition on growth and biomass allocation of purple loosestrife. OECOLOGIA 113:82-93. 1998.

Orban, I., Bouharmont, J.

Megagametophyte development of *Nymphaea nouchali* Burm. F. (Nymphaeaceae). BOT. J. LINNEAN SOC. 126:339-348. 1998.

Parkes, M.E., McBride, A.D., Waalkens, A.

Treatment of dilute piggery effluent with vertical flow reed beds. J. ENVIRON. QUAL. 27(4):783-788. 1998.

Pedersen, O., Jorgensen, L.B., Sand-Jensen, K.

Through-flow of water in leaves of a submerged plant is influenced by the apical opening. PLANTA 202:43-50. 1997.

Peinado, M., De Henares, A., Alcaraz, F., Delgadillo, J.

Syntaxonomy of some halophilous communities of North and Central America. PHYTOCOENOLOGIA 25(1):23-31. 1995.

Pelton, D.K., Levine, S.N., Braner, M.

Measurements of phosphorus uptake by macrophytes and epiphytes from the LaPlatte River (VT) using ³²P in stream microcosms. FRESHWATER BIOL. 39:285-299. 1998.

Perrow, M.R., Schutten, J.H., Howes, J.R., Holzer, T., et al

Interactions between coot (*Fulica atra*) and submerged macrophytes: the role of birds in the restoration process.

HYDROBIOLOGIA 342/343:241-255. 1997.

Pollock, M.M., Naiman, R.J., Hanley, T.A.

Plant species richness in riparian wetlands - a test of biodiversity theory.

ECOLOGY 79(1):94-105. 1998.

Ramelow, G.J., Yao, H., Zhuang, W.

Metal ion binding by biomass derived from nonliving algae, lichens, water hyacinth root and sphagnum moss.

IN: WASTEWATER TREATMENT WITH ALGAE, Y.S. WONG, N.F.Y. TAM, EDS., SPRINGER-VERLAG BERLIN, PP. 93-110. 1998.

Raspopov, I.M.

Aquatic vascular plants of Russian water bodies.

IN: PROC. 10TH EWRS INTERNAT'L SYMP. AQUATIC WEEDS, EUROPEAN WEED RESEARCH SOC., 21-25 SEPTEMBER 1998, LISBON, PP. 107-109. 1998.

Robach, F., Eglin, I., Tremolieres, M.

Species richness of aquatic macrophytes in former channels connected to a river: a comparison between two fluvial hydrosystems differing in their regime and regulation.

GLOBAL ECOLOGY AND BIOGEOGRAPHY LETTERS 6:267-274. 1997.

Rogers, S.D.

Growing the Madagascar lace plant.

AQUATIC GARDENER 11(1):17-18. 1998.

Root, B.G.

Alkaline wetland vegetation dynamics at North Dakota piping plover nesting beaches.

PH.D. DISSERTATION, UNIVERSITY OF MISSOURI, COLUMBIA, 332 PP. 1996.

Rout, N.P., Tripathi, S.B., Shaw, B.P.

Effect of salinity on chlorophyll and proline contents in three aquatic macrophytes.

BIOLOGIA PLANTARUM 40(3):453-458. 1998.

Salmon, C., Crabos, J.L., Sambuco, J.P., Bessiere, J.M., et al

Artificial wetland performances in the purification efficiency of hydrocarbon wastewater.

WATER, AIR AND SOIL POLLUTION 104:313-329. 1998.

Schrenk, C., Pflugmacher, S., Bruggemann, R., Sandermann, H., et al

Glutathione S-transferase activity in aquatic macrophytes with emphasis on habitat dependence.

ECOTOXIC. ENVIRON. SAFETY 40:226-233. 1998.

Schutz, W.

Seed dormancy cycles and germination phenologies in sedges (*Carex*) from various habitats.

WETLANDS 18(2):288-297. 1998.

Schwarz, A.M., Paskewitz, S.M., Orth, A.P., Tesch, M.J., et al

The lethal effects of *Cyperus iria* on *Aedes aegypti*.

J. AMER. MOSQUITO CONTROL ASSOC. 14(1):78-82. 1998.

Shearer, J.F.

Biological control of hydrilla using an endemic fungal pathogen.

J. AQUAT. PLANT MANAGE. 36:54-56. 1998.

Shrestha, P., Janauer, G.A.

Spatial variation in abundance pattern of aquatic plants by using Kohler index in Lake Phewa, Nepal.

IN: PROC. 10TH EWRS INTERNAT'L SYMP. AQUATIC WEEDS, EUROPEAN WEED RESEARCH SOC., 21-25 SEPTEMBER 1998, LISBON, PP. 123-126. 1998.

Sidorkewicz, N.S., Lopez Cazorla, A.C., Fernandez, O.A., Mockel, G.C., et al

Effects of *Cyprinus carpio* on *Potamogeton pectinatus* in experimental culture: the incidence of the periphyton.

IN: PROC. 10TH EWRS INTERNAT'L SYMP. AQUATIC WEEDS, EUROPEAN WEED RESEARCH SOC., 21-25 SEPTEMBER 1998, LISBON, PP. 127-130. 1998.

Sisneros, D., Lichtwardt, M., Greene, T.

Low-dose metering of endothall for aquatic plant control in flowing water.

J. AQUAT. PLANT MANAGE. 36:69-72. 1998.

Sloey, D., Schenck, T., Narf, R.

Distribution of aquatic invertebrates within a dense bed of Eurasian watermilfoil (*Myriophyllum spicatum* L.).

J. FRESHWATER ECOL. 12(2):303-313. 1997.

Smart, R.M., Dick, G.O., Doyle, R.D.

Techniques for establishing native aquatic plants.

J. AQUAT. PLANT MANAGE. 36:44-49. 1998.

Ssymank, A., Hauke, U.

Landscape ecology of calcareous fens (Caricion davallianae) and the Cladietum

marisci in the lowlands of NE-Germany and their relevance for nature conservation in the European Union Habitats Directive.

PHYTOCOENOLOGIA 28(1):105-142. 1998.

Wang, W., Lewis, M.A.

Metal accumulation by aquatic macrophytes.

IN: PLANTS FOR ENVIRONMENTAL STUDIES, W. WANG, J.W. GORSUCH, J.S. HUGHES, EDS., CRC LEWIS PUBLISHERS, NEW YORK, PP. 367-416. 1997.

Weaver, M.J., Magnuson, J.J., Clayton, M.K.

Distribution of littoral fishes in structurally complex macrophytes.

CAN. J. FISH. AQUATIC SCI. 54(10):2277-2289. 1997.

Weil, C., Kollaard, W., Malcolm, I., Fankhauser, O.

Constructed wetlands for the treatment of farmstead runoff in eastern Ontario, Canada.

FOURTH INTERNAT'L DAIRY HOUSING CONF., ASAE, 28-30 JAN. 1998, ST. LOUIS, MO, J.P. CHASTAIN, ED., PP. 157-164. 1998.

Wells, R.D.S., de Winton, M.D., Clayton, J.S.

Successive macrophyte invasions within the submerged flora of Lake Tarawera, Central North Island, New Zealand.

NEW ZEALAND J. MAR. FRESHWATER RES. 31(4):449-459. 1997.

Wu, J., Seliskar, D.M.

Salinity adaptation of plasma membrane H⁺-ATPase in the salt marsh plant *Spartina patens*: ATP hydrolysis and enzyme kinetics.

J. EXPER. BOT. 49(323):1005-1013. 1998.

Yang, Y-P., Yen, S-H.

Notes on *Limnophila* (Scrophulariaceae) of Taiwan.

BOT. BULL. ACAD. SIN. 38:285-295. 1997.

Yoshimura, T., Kuramochi, H., Konnai, M., Seto, H., et al

Effects of plant growth regulators on shoot growth and flowering of a perennial paddy weed, *Sagittaria pygmaea* Miq.

Zhulidov, A.V., Headley, J.V., Robarts, R.D., Nikanorov, A.M., et al

Concentrations of Cd, Pb, Zn and Cu in contaminated wetlands of the Russian arctic.

MARINE POLL. BULL. 35(7-12):252-259. 1997.

MEETINGS

INTERNATIONAL TRAINING COURSE ON AQUATIC PLANT BIOLOGY AND CONTROL.

June 28-July 14, 1999. Gainesville, Florida.

Produced by the University of Florida Center for Aquatic and Invasive Plants, this three-week course will include 1) a week of intensive classroom training on aquatic plant biology and control; 2) a week of field work collecting and rearing insects and applying herbicides; and 3) attendance at the Aquatic Plant Management Society annual meeting in Asheville, North Carolina. Attendees will be responsible for travel and living expenses.

Contact: Center for Aquatic and Invasive Plants, IFAS-University of Florida, 7922 NW 71 ST, Gainesville, FL 32653; (352) 392-9613; E-mail: aqplants@gnv.ifas.ufl.edu

INTERNATIONAL CONFERENCE ON PHRAGMITES-DOMINATED WETLANDS.

Their Functions and Sustainable Use.

April 18-23, 1999. Třeboň, Czech Republic.

This conference is convened by the Institute of Botany of the Academy of Sciences of the Czech Republic, an organization long respected for its work on *Phragmites australis*, the most common dominant plant of European temperate wetlands. Common reed is valued for maintaining stability of river and lake margins, and is considered a most important sanctuary for wildlife. In Europe, common reed is in the process of a general die-back, whereas in North America the plant seems to be expanding.

The purpose of this conference is to provide an international forum for the exchange of state-of-the-art information on *Phragmites*-dominated wetlands, especially on biogeochemical cycling, growth dynamics and ecophysiology.

Contact: Phragmites Conference Secretariat, Institute of Botany, AS Cr, Dukelská 145, CZ-379 82 Trebon, Czech Republic; E-mail: cizkova@butbn.cas.cz; WWW: <http://www.butbn.cas.cz/phraconf>

SIXTH SYMPOSIUM ON BIOGEOCHEMISTRY OF WETLANDS.

July 11-14, 1999. Ft. Lauderdale, Florida.

This symposium will emphasize various biogeochemical processes occurring in freshwater and estuarine wetlands. Topics include: the roles of wetlands in improving water quality, global climatic change and nutrient cycling; plant-soil interactions in wetlands; biogeochemical indicators; heavy-metal chemistry in wetlands; reactions of toxic organics in wetlands; and wetland eutrophication.

Contact: IFAS Office of Conferences, (352)392-5830; E-mail: mrp@gnv.ifas.ufl.edu; WWW: <http://gnv.ifas.ufl.edu/~conferweb/#upcoming>

FLORIDA LAKE MANAGEMENT SOCIETY, 10TH ANNUAL MEETING.

May 26-28, 1999. Safety Harbor, Florida.

Meeting subjects include all issues related to lake and watershed management in Florida. This year's meeting will include case histories of in-lake restorations, watershed management, fisheries management, aquatic plant management, and public outreach.

Contact: Nancy Page, Conference Coordinator, (727) 464-4425; E-mail: npage@co.pinellas.fl.us

SOCIETY OF WETLAND SCIENTISTS, 20TH ANNUAL MEETING.

June 6-12, 1999. Norfolk, Virginia.

The theme of the meeting is, "Wetlands Function, Assessment and Management", with sessions on wetland ecosystem types, dynamic processes and functions, wetland modification and manipulation, analytic techniques, wetland policy and management, and wetland education and outreach.

Contact: E-mail: sws@vimw.edu; WWW: <http://www.sws.org>

NALMS: 8th ANNUAL SOUTHEASTERN LAKES MANAGEMENT CONFERENCE.

Developing Watershed Solutions: Community Partnerships.

March 24-27, 1999. Clemson, South Carolina.

One objective of this meeting is "to explore ways to restore, enhance and preserve watersheds while supporting economic development". Session topics will include eutrophication, science programs for children, limnological studies, working with the media, aquatic weed control and more. Workshops on building effective lake associations also are planned.

Contact: Barbara Speziale, Dept. of Biological Sciences, 132 Long Hall, Clemson University, Clemson, SC 29634-1903; (864) 656-1550; E-mail: bjspz@clemson.edu; WWW: <http://www.nalms.org/indexf.htm>

AMERICAN FISHERIES SOCIETY, 129TH ANNUAL CONFERENCE.**August 29-September 2, 1999. Charlotte, North Carolina.**

The meeting theme is "Integrating Fishery Principles from Mountain to Marine Habitats."

Contact: E-mail: fisheries@fisheries.org

NORTH AMERICAN BENTHOLOGICAL SOCIETY, 47TH ANNUAL MEETING.**May 25-28, 1999. Duluth, Minnesota.**

NABS 99 Plenary Session is called, "Current Issues in Aquatic Sciences: Examples from the Great Lakes." In addition there will be Special Sessions on Great Lakes benthic science, the ecology and management of large rivers, aquatic ecosystem restoration, "interactive constraints", Native American environmental issues, and others on taxonomy, the role of fish in food webs, lentic food webs, and marsh and wetlands ecology. Pre-conference workshops on Geographical Information Systems (GIS) for aquatic professionals, midge taxonomy, and general taxonomy also will be held.

Contact: WWW: <http://www.d.umn.edu/nabs99/>

SHORT COURSE ON ENVIRONMENTAL MODELLING WITH GIS AND REMOTE SENSING.**April 12-16, 1999. Enschede, The Netherlands.**

Contact: J. Looijen, ITC, POB 2, 7500 AA Enschede, The Netherlands; +31 (0) 53 4874265; E-mail: looijen@itc.nl

COMMUNITIES WORKING FOR WETLANDS, 3RD ANNUAL CONFERENCE.**February 18-20, 1999 New Orleans; March 18-20, 1999 San Francisco; April 8-10, 1999 Indianapolis;****May 6-8, 1999 Andover, Massachusetts.**

These meetings of roundtable discussions and workshops "are structured to encourage free, interactive discussion, led by participants selected for their experience in the subject", and are for everyone from landowners and gardeners to elected officials and government reps. The workshops include "wetlands primer", "landscaping wetlands" and "working with your corporate partner". Pre-conference registration fees run from \$100 for students to \$350 for corporate people, plus fees for workshops and field trips.

Contact: Conference, c/o Terrene Institute, 4 Herbert Street, Alexandria, VA 22305 (703)548-5473. E-mail: terrinst@aol.com

ECOSYSTEMS RESTORATION AND CREATION, 26TH ANNUAL CONFERENCE.**May 13-14, 1999. Tampa, Florida.**

This annual forum provides for the exchange of results of scientific research in the restoration, creation, mitigation, permitting, and management of freshwater and marine wetlands and uplands. (The conference has expanded its scope to include mixed and upland ecosystem concerns.)

Contact: Frederick J. Webb, Dean of Environmental Programs, Hillsborough Community College, Plant City Campus, 1206 N. Park Road, Plant City, FL 33566, (813) 757-2104. E-mail: webb@mail.hcc.cc.fl.us

PREDICTING PLANT AND ANIMAL OCCURRENCES: ISSUES OF SCALE AND ACCURACY.**October 19-22, 1999. Snowbird, Utah.**

This is an international conference to bring together scientists and land managers involved with habitat modeling, with "a focus on the future of modeling to support multi-scale landscape planning efforts for wildlife conservation and management." Manuscripts will be peer reviewed and published as a book.

Contact: Mr. Mike Scott (208) 885-6960; Dr. Patricia Heglund (208) 885-2665; or Ms. Kathy Merk (208) 885-2750, or see the web site: http://www.ets.uidaho.edu/coop/1999_symposium.htm

AQUATIC WEED CONTROL, AQUATIC PLANT CULTURE AND REVEGETATION SHORT COURSE.**May 17-20, 1999. Ft. Lauderdale, Florida.**

A photo-review of what happened at the 1998 short course: New and used information about aquatic plant control, identification, culture and use, plus up to 20 Continuing Education Units (CEUs) awarded for Florida State Pesticide Applicator License recertification. These annual workshops are put on by Vernon Vandiver, David Sutton and David Buchanan of the University of Florida, Ft. Lauderdale Research and Education Center.

Contact: Vandiver at vvv@ufl.edu or Sutton at dlsutton@ufl.edu, or contact the FREC, 3205 College Avenue, Ft. Lauderdale, FL 33314 (954) 475-8990.

Continued - next page

NEW IDENTIFICATION TOOL!

Grasses, Sedges and Rushes of Wetlands Identification Deck -- With notes about wildlife use

A handy new identification tool, similar to the very popular *Aquatic Plants Identification Deck*, is "at the printer" and is expected to be for sale in April, 1999. The *Grasses, Sedges and Rushes of Wetlands Identification Deck* is a stack of 3" X 4" laminated cards, bound with two rings to open as a book. The deck is sturdy enough to withstand extensive field use in a wetland environment. It has identification text and line drawings on one page facing color photographs of the plants on the other. Written by Victor Ramey, with the cooperation of botanist and noted wetland plant expert, David Hall, this ID deck treats 84 species of the most common and/or important grasses, sedges and rushes that occur in wetlands, including 22 non-native species. Each plant is well-described in terms that are readily understood by non-botanists. The ID deck is illustrated with 150 color photographs and 70 line drawings by Ann Murray, and is indexed according to scientific names, common names, and inflorescence shapes.

Incidental notes on each plant include its documented use by ducks, geese, swans and other waterfowl, since native grasses, sedges and rushes provide food, shelter and nesting habitat to many kinds of birds and other wildlife. The deck will teach managers, field personnel, students, and other wetlands enthusiasts to distinguish between the exotic elephant grass and native panic grasses, exotic para grass and native maidencane, and to identify and distinguish between 80 other grasses, sedges and rushes from *Amphicarpum muhlenbergianum* (blue maidencane) to *Zizaniopsis miliacea* (giant cut grass).

Each *Grasses, Sedges and Rushes of Wetlands Identification Deck* (Publication Number SP255) is \$12 plus S/H. It will be available from the University of Florida, IFAS Publications, 1-800-226-1764. **Please note that this item will not be available until April, 1999!**

MEETINGS - Continued

INTERNATIONAL SYMPOSIUM ON BASS SPP. CULTURE: BASIC AND APPLIED ASPECTS. September 13-16, 1999. Cestellón de la Plana, Spain.

The aim of the symposium is to collect all the current basic and applied studies conducted in the culture of American, European and Asiatic bass. Sessions include: reproduction, pathology, nutrition and metabolism, growth and development, genetics, and culture techniques and commercialization.

Contact: Liz Reed, E-mail: e.reed@elsevier.co.uk; WWW: <http://www.elsevier.nl/locate/aqua99>

MARKETING & SHIPPING LIVE AQUATIC PRODUCTS 99. November 14-17, 1999. Seattle, Washington.

"Technological refinements are revitalizing the centuries old practice of providing live aquatic products for display or consumption far from the point of harvest...This conference will assist fishermen, growers and marketers of aquatic products to supply the expanding market while complying with increased restrictions and regulations." Major topics include: resources, shipping, harvesting, physiology, exotics, holding, reconditioning, regulations, packaging, water quality, marketing, research, and environmental, sociological, political and humanitarian considerations.

Contact Conference Manager, John B. Peters, Nor'Westerly Food Technology Services, 20455 - 1st Ave. NE, Suite C 303, Poulsbo, WA 98370-9329. E-mail: johnbpeters@compuserve.com

Some responses to our last issue:

"The interesting article on the edibility of *Trapa bispinosa* reminded me of something I saw during a recent trip to the Landesmuseum in Zurich, Switzerland. A display of the foods used by the ancient Celtic tribes and Swiss lake-dwellers of the area included a *Trapa* nut, apparently *T. natans*." **Dr. Susan Sprecher, U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi.**

"It was funny reading about the fruits of *Trapa natans* from Burma made into rosaries and sold in Italy, because I remembered that *Trapa natans* is an invasive plant proliferating in one of the lakes in North Italy." **Dr. Francisco Comín, Universitat de Barcelona, Spain.**

Johnson's Seagrass Listed as Threatened

Agents of the National Marine Fisheries Service have issued a final rule (63 FR 49035) listing Johnson's seagrass, *Halophila johnsonii*, as a threatened species under the Endangered Species Act, with the conclusion that it is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Johnson's seagrass has one of the smallest geographic distributions of any seagrass; it is found only in lagoons on the southeastern coast of Florida.

Halophila johnsonii is dioecious (contains flowers of only a single sex on one plant). However, the male flower has never been recorded in the field or in laboratory culture. The absence of male flowers supports the hypothesis that sexual reproduction is absent in this species. Scientists have not observed new *Halophila* plants growing from root or stem fragments. Rather, the plant extends by branching and by growth of the rhizomes. This limited reproductive capacity further threatens the ability of the rare plant to survive human-induced or natural disturbances. Because it is most abundant amidst the heavy boating traffic of south Florida coastal area inlets and channels, potential threats to the diminutive seagrass include dredging activities, boat propeller and anchor damage, and storm events.

Identifying characteristics of *H. johnsonii* include smooth linear leaves with entire margins. Leaves are 10-20 mm long on long petioles and occur in pairs at each node. The plant has a creeping rhizome and sessile female flowers. The plant tolerates broad ranges of salinity, temperatures, and water levels. It is found on sandy intertidal shoals where it is exposed to drying, intense sunlight and extreme temperature changes during low tide. It also is found in deeper channels with swift, eroding currents.

Johnson's seagrass is one of twelve species of the genus *Halophila*. Most *Halophila* species are less than four inches tall, shallow rooted, and have two to three orders of magnitude less biomass per unit area compared to all other seagrasses. In contrast to the restricted range of Johnson's seagrass, other members of the genus have a pantropical range. In addition, *Halophila* seagrasses cover the greatest range of water depths for seagrasses. They have been found growing in water depths of more than 100 feet deep, as well as in shallow estuaries and intertidal shoals. These seagrasses are known to provide a food source to green sea turtles, West Indian manatees, and dugongs.

References:

- 1) Durako, M. and F. Wettstein. 1994. Johnson's seagrass. The Palmetto, Winter 1994, pp. 3-5.
- 2) Eiseman, N.J. and C. McMillan. 1980. A new species of seagrass, *Halophila johnsonii*, from the Atlantic coast of Florida. Aquatic Botany 9:15-19.
- 3) U.S. Federal Register 63(177):49035. 1998.

NOTE: The **APIRS** database contains 27 references on *Halophila johnsonii*.

The Literature on Seagrasses

A seemingly little known nugget of information within the Aquatic and Wetland (and now Invasive) Plant Information Retrieval System (**APIRS**) is the literature collection on seagrasses. Probably due to our increasingly complex yet still not completely accurate name, few people seem to realize that we also collect the literature on our saltier friends, the seagrasses. This little-used body of literature on seagrasses constitutes approximately 10% of our collection, or approximately 5,000 references. We plan to increase the visibility of the seagrass collection to broader circles of researchers with hopes of increasing the use of the collection and possibly finding financial support to continue it. Please feel free to share this newsletter with any colleagues working on any aspect of seagrasses.

For those who work in the marine environment, here is a list of the number of references in the **APIRS** database on some of the various species of seagrass. The first number given indicates the number of citations where the species name is found *in the text but not the title* of the reference; the second number indicates the number of citations where the species name is found *in the title* of the reference (e.g., more specific or relevant references). Of course, many references refer to more than one species of seagrass.

<i>Zostera</i> - 670 (text), 510 (title)	(total=1,180)
<i>Ruppia</i> - 627, 130	(total=757)
<i>Thalassia</i> - 479, 131	(total=610)
<i>Halodule</i> - 429, 67	(total=496)
<i>Syringodium</i> - 307, 33	(total=340)
<i>Halophila</i> - 294, 77	(total=372)
<i>Cymodocea</i> - 195, 62	(total=257)
<i>Posidonia</i> - 176, 238	(total=414)
<i>Enhalus</i> - 92, 5	(total=97)
<i>Phyllospadix</i> - 58, 17	(total=75)
<i>Amphibolis</i> - 55, 18	(total=73)
<i>Thalassodendron</i> - 48, 17	(total=65)

Total records in this list: 4,736

Sample keywords that can be used in combination with these plant species include 'host plants' (over 700 references), 'physiology/photosynthesis' (over 650 references), 'reproduction' (over 300 references), 'fish' (over 300 references), and 'epiphytes' (over 250 references). Any keyword may be used when searching the **APIRS** database.

The **APIRS** collection contains hard copies of over ninety percent of the references listed in the database, and is available for the free use of researchers. In exchange, we expect those researchers to contribute reprints of their published work to **APIRS**. To access the database, go to our website at <http://aquat1.ifas.ufl.edu/> and click on the **Online APIRS Database** link. You must have a telnet application specified in your Internet browser. To request free searches of the database, contact Karen Brown at kpb@gnv.ifas.ufl.edu or use the address on the back page of this issue. Bibliographies can be printed and mailed, or sent via e-mail.

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AQUAPHYTE

This is the newsletter of the Center for Aquatic and Invasive Plants and the Aquatic, Wetland and Invasive Plant Information Retrieval System (APIRS) of the University of Florida Institute of Food and Agricultural Sciences (IFAS). Support for the information system is provided by the Florida Department of Environmental Protection, the U.S. Army Corps of Engineers Waterways Experiment Station Aquatic Plant Control Research Program (APCRP), the St. Johns River Water Management District and UF/IFAS.

**EDITORS: Victor Ramey
 Karen Brown**

AQUAPHYTE is sent to managers, researchers and agencies in 71 countries around the world. Comments, announcements, news items and other information relevant to aquatic, wetland and invasive plant research are solicited.

Inclusion in *AQUAPHYTE* does not constitute endorsement, nor does exclusion represent criticism, of any item, organization, individual, or institution by the University of Florida.



Salvinia molesta found in U.S.

The famously disruptive floating plant, giant salvinia (*Salvinia molesta*), has finally been discovered established in the United States, covering significant areas of rivers in the states of Texas and Louisiana. Efforts are underway to eliminate these infestations.

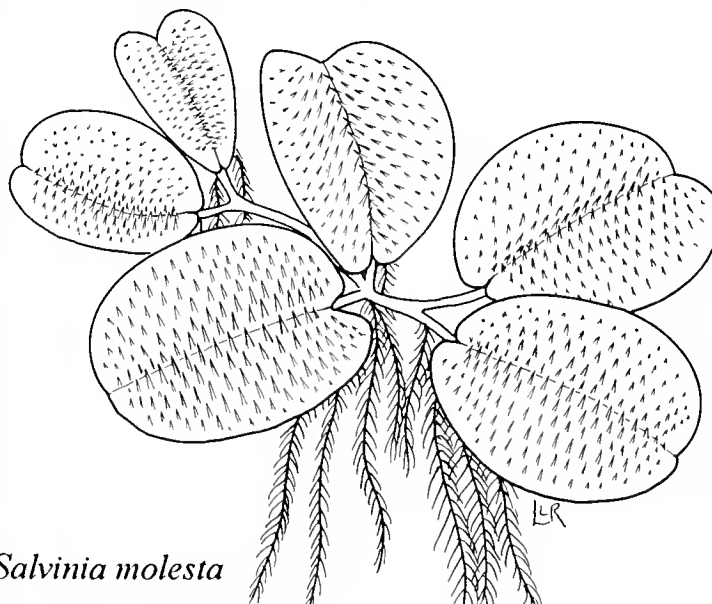
In an effort to identify new infestations of this very aggressive **aquatic weed**, and to help speed the deployment of chemical control actions against the plant, the U.S. Geological Survey has issued a special alert to aquatics managers:

REPORT SUSPECTED SIGHTINGS.

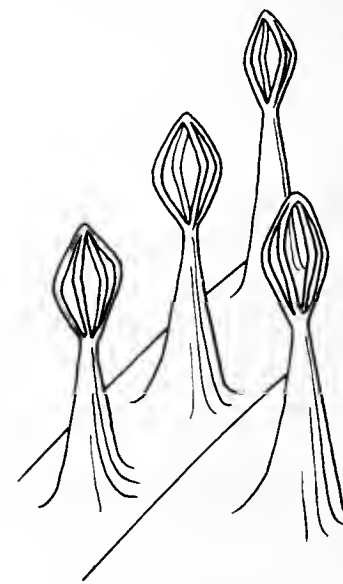
Giant salvinia has oblong floating leaves, ½ to 1-½ inches, often folded and compressed into upright chains. Leaf surfaces have white bristles or hairs joined at the tips to form a "cage", visible with a hand lens. Bristles give a velvety appearance and repel wetting.

Please report suspected giant salvinia occurrences to your state department of wildlife or environmental protection, *and also* please report to the U.S. Geological Survey. Ms. Colette Jacono, a biologist with the USGS, is mapping new occurrences and also acting as a clearing house of identification and control information. In addition, informative flyers are available from her for distribution to water and wetland management agencies, fish camps, sports organizations, homeowners associations and others likely to encounter giant salvinia.

For more information, contact Ms. Jacono (toll free) at 1-877- 786-7267, or view their web site at: <http://nas.er.usgs.gov/ferns>



Salvinia molesta



surface hairs or bristles

XH
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V-19
#2

A Q U A P H Y T E

A NEWSLETTER ABOUT AQUATIC, WETLAND AND INVASIVE PLANTS

Center for Aquatic and Invasive Plants

with support from

The Florida Department of Environmental Protection,

Bureau of Invasive Plant Management

The U.S. Army Corps of Engineers,

Waterways Experiment Station,

Aquatic Plant Control Research Program

The St. Johns River Water Management District



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Invasives Information Retrieval System

The **APIRS** office, long known for its information gathering and dissemination relating to aquatic plants, native and non-native, has widened its focus to include invasive plants of uplands as well. In fact, the research center of which **APIRS** is a part has changed its name to the Center for Aquatic and Invasive Plants. Many of the researchers associated with the Center are already well known for their work on invasive plants.

As a first step, **APIRS database manager**, Karen Brown, and reader, Mary Langeland, have begun collecting the literature of the invasive plants on the two lists of the Florida Exotic Pest Plant Council (FLEPPC), as well as the Noxious Weed List of the Florida Department of Agriculture and Consumer Services (FDOACS). The FLEPPC lists are Category I plants (that are invading and disrupting native habitats, 65 species) and Category II plants (that have shown a potential to disrupt native habitats, 60 species). (**FLEPPC:** <http://www.fleppc.org>) The FDOACS lists 63 species, some of which are in common with the FLEPPC lists. (**FDOACS:** <http://fdoacs.state.fl.us/~pi/noxioustbl.htm>)

Support is being sought to expand our information gathering and dissemination capabilities more quickly, so that the literature on additional plants on "invasives and noxious lists" of other states and countries can be collected, cataloged, disseminated and used.

Already, several hundred researchers routinely contribute their articles and reports for inclusion in the **APIRS** system and database. Other researchers and authors who work on invasive plants, and who may not be aware of our established system, are encouraged to join our modest partnership. Works will be entered into our science library and central source for aquatics and invasives literature. In exchange, our information and referral services will remain free of charge to our contributors, as they have been for the past 18 years. For more information, contact Karen Brown at kpb@gnv.ifas.ufl.edu

As was the case for aquatic plants, projects manager Victor Ramey is building a thorough collection of photographs and line drawings of invasive plants. These and other resources are being used to develop all kinds of information and education products, from museum backdrops to ID decks, from invasives posters to coloring books, from magazine articles to homeowner slide shows.

And, of course, our **web site** is expanding its content as well. So far, fairly extensive information about 16 invasive plants is online at our site. There also are pictures and drawings of a number of other invasive plants. See it all at: <http://plants.ifas.ufl.edu>

APIRS has a new color catalog with full descriptions of our free and for-sale products and services. Included are database instructions, lists of plants featured in various publications, full lists of available slides and drawings, and ordering information. Contact the **APIRS** office for a copy of the new catalog: varamey@nersp.nerdc.ufl.edu



Burma reed
Neyraudia reynaudiana
Photo by Ann Murray

Invasive Plants

Lantana, shrub verben

Lantana camara L.

Lantana camara L. - deciduous shrub to 6 ft tall; **stems** square, covered with bristly hairs, often with thorns and/or small prickles; **leaves** opposite, simple, with petioles (leaf stems) strongly aromatic; **leaf blades** oval, rough, hairy to 6 in. long to 2.5 in. wide, veins conspicuous; **leaf margins** coarsely serrate; **inflorescence** a stalked dense cluster of flowers; **flowers** small, multicolored, in a single cluster, may be white to pink or lavender, yellow to orange or red, color changing over time; **fruit** small, round, fleshy, 2-seeded drupe, green turning purple to blue-black.

"There grow on this island many curious shrubs, particularly a beautiful species of lantana. It grows in coppices in old fields, about five or six feet high, the branches adorned with rough serrated leaves, which sit opposite, and the twigs terminated with umbelliferous tufts of orange-colored blossoms, which are succeeded by a cluster of small blue berries; the flowers are of various colors, on the same plant, and even in the same cluster, as crimson, scarlet, orange and golden yellow; the whole plant is of a most agreeable scent."

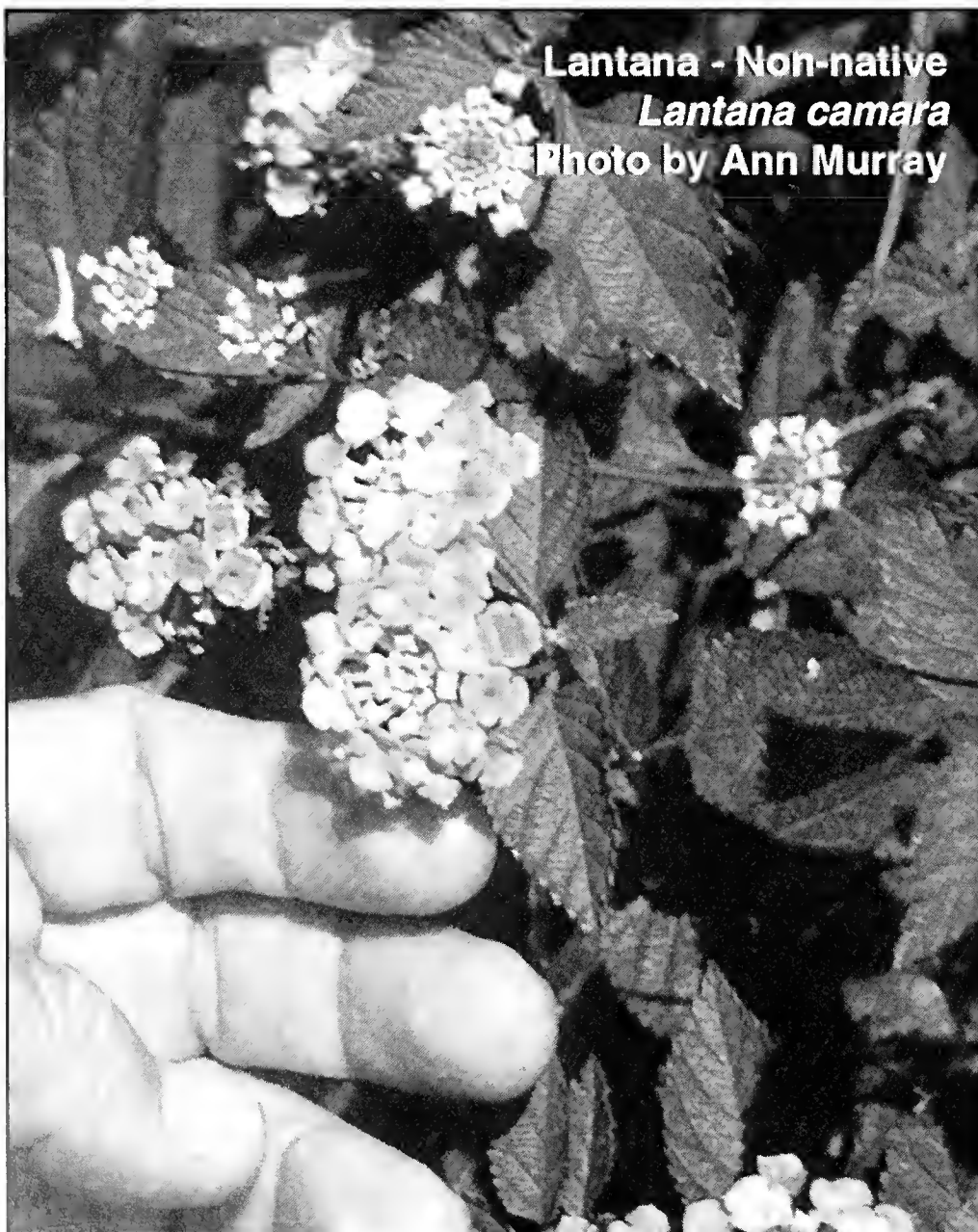
from *The Travels of William Bartram*, his observations of lantana in 1773 while exploring the islands of Lake George in northern Florida.

L *antana camara*, lantana, and its many cultivated varieties, has a mixed reputation. On one hand, lantana is listed by Holm *et al.* as one of the worst weeds in all the world: a thicket-forming menace in 47 countries that has "infested millions of hectares of natural grazing lands" (especially in Asia and Africa) and that is a weed in 14 major crops including coffee, oil palms, coconuts, cotton, bananas, pineapples, sugarcane, sandalwood, tea, rubber and rice. In Indonesia, lantana is the most dominant species among 54 species found on the east slope of the Candikuning pine plantation. Reportedly, in India the lantana invasion in some places has been so complete as to require the moving of several entire villages. In Hawaii, several hundred thousand acres are infested with lantana;

lantana infests four million acres in Australia. What's more, *Lantana camara* leaves and fruit (green and mature) are very toxic, having been blamed in the deaths of animals as diverse as livestock, parrots, rabbits and snakes, as well as humans.

On the other hand, *Lantana camara* and its varieties are frequently planted in the U.S. to attract butterflies, is planted to herald the arrival of spring at Boston Garden, and is still considered one of the "10 favorite plants of Malaysians." In the US, some nurseries tout lantana as a native plant; it is sold over the internet from companies in Ohio, Texas and New Mexico. According to Indian research, there is evidence that lantana extracts could be used for weed control in rice.

Notwithstanding Bartram's observations of lantana in Florida more than 200 years ago, *Lantana camara* is listed as a Category I non-native, invasive plant by the Florida Exotic Pest Plant Council (FLEPPC). (However, lantana is not listed on the Noxious Weed List of the Florida Department of Agriculture and Consumer Affairs (FDACS).) FLEPPC believes lantana to be a native of the West Indies, not of Florida. Others believe it to be from Argentina.



Lantana camara grows well in full-sun disturbed places, but also grows well under shade. It is a long-lived plant, and can form dense thickets in pastures, forests and along fence lines. It prefers well-drained soils, and, once established, requires only infrequent watering. It is spread by birds as well as humans. Lantana leaves are damaged at 27 degrees F. Lantana is allelopathic; it releases chemicals into the soil to prevent other plants from germinating. Lantana is not easy to control. Experience shows that burning, cutting and digging lantana often results in increased germination and more shoot growth. As for biological control possibilities, various arthropods and fungal pathogens have been or are being tested.

Florida's case is complicated by the fact that this state has at least two species of lantana believed to be native: *Lantana depressa*, Florida lantana, and *Lantana involucrata*, wild sage. Florida lantana, an endangered plant, has yellow flowers and tapered leaves. It is believed that *Lantana camara* hybridizes with Florida lantana, thus contaminating the Florida lantana gene pool. It is not easy to tell just by looking whether a plant is a 100% *Lantana camara* or a 50% *Lantana depressa*. Sales and plantings of lantana hybrids of many colors further complicate the scenario. The other lantana native to Florida, wild sage (*L. involucrata*), is decidedly less showy, having small whitish yellow-centered flowers and smaller, rounder leaves. Finally, another non-native lantana, *Lantana montevidensis*, trailing lantana, is sold to homeowners throughout the state. Its all-mauve lantana flowers are becoming more familiar, although *L. montevidensis* does not seem to be invasive.



Wild sage - Native
Lantana involucrata
Photo by Ann Murray

Some references from the **APIRS** invasive plant database:

- Gentle, C.B. and J.A. Duggin.** 1997. Allelopathy as a competitive strategy in persistent thickets of *Lantana camara* L. in three Australian forest communities. *Plant Ecology* 132: 84-95.
- Greathead, D.J.** 1973. Progress in the biological control of *Lantana camara* in East Africa and discussion of problems raised by the unexpected reaction of some of the more promising insects of *Sesamum indicum*. pp. 89-92 in Dunn, P.H. (ed.), *Proc. 2nd Int. Symp. Biol. Control Weeds. Comm. Inst. Biol. Control Misc. Publ. 6*. 225 pp.
- Holm, L.G., Plucknett, D.L., et al.** 1977. *The world's worst weeds - distribution and biology*. University Press of Hawaii. 609 pp.
- Langeland, K.A. and Craddock Burks, K. (eds.)** 1998. *Identification & biology of non-native plants in Florida's natural areas*. University of Florida, Gainesville. 165 pp.
- Wolfson, S.L. and T.W. Solomons.** 1964. Poisoning by fruit of *Lantana camara*. *Am J. Dis. Child*, 107: 109-112.



Jess VanDyke
at Lake Jackson sinkhole
Photo by Ann Murray

No Aquatic Weeds On Jackson Prairie

Outstanding Florida Water Body, Lake Jackson (Tallahassee), is known nationally as a premiere bass fishing lake. And over the years, aquatic weed and water quality concerns in the lake have been the subject of countless homeowners' meetings and of primary interest to lake management personnel. However, its bass reputation and aquatic weed problems became much less consequential on September 16 when a sinkhole suddenly drained more than half the lake of every last gallon of water, not to mention every last fish and alligator. It is now possible to walk from shore to shore--but steer clear of the sinkhole.

Jess VanDyke, long-time regional biologist with the Bureau of Invasive Plant Management (Florida Department of Environmental Protection) was there when it happened. "It was spectacular: animals trying to scramble out; a whirlpool of gators, birds and bass went down the hole," said VanDyke. Lake Jackson is one of Florida's disappearing lakes, lakes with sinkholes that are known to drain periodically. Lake Jackson, for example, has drained 4 times previously in the 20th century, in 1907, 1933, 1957, 1982 and now in 1999.

"Our records show that in 1982 the lake refilled from rainfall within about 6 months. In 1957 there was a drought, so it took much longer to refill. It's all about long term rainfall patterns," says VanDyke. It is expected that the lake will eventually collect water and again become a top-notch fishing lake.

For more information, contact Jess VanDyke, the regional biologist for the northwest Florida region (which includes Lake Jackson), at Bureau of Invasive Plant Management, 3915 Commonwealth Blvd., Tallahassee, FL 32399; (850) 487-2600. E-mail: Jess.VanDyke@dep.state.fl.us

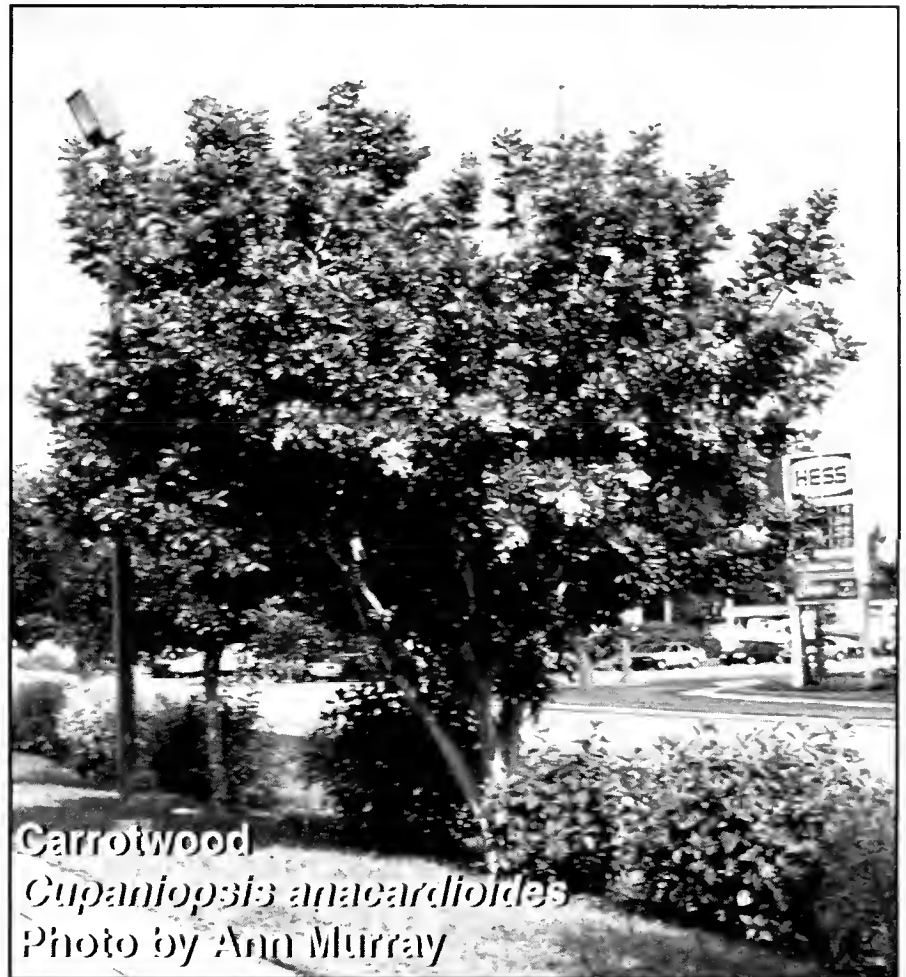
For more pictures, go to our website: <http://plants.ifas.ufl.edu/depguys.html>

Florida Ag Adds 11

Eleven terrestrial weeds were recently added to the official "Noxious Weed List" of the Florida Department of Agriculture and Consumer Services (FDOACS). The Noxious Weed List prohibits introducing, possessing, moving, growing and selling these species. The full list can be seen at <http://doacs.state.fl.us/~pi/noxioustbl.htm>

The 11 new terrestrial weeds added to the official noxious weeds list are:

- Air potato** (*Dioscorea bulbifera*)
- Burma reed** (*Neyraudia reynaudiana*)
- Carrotwood** (*Cupaniopsis anacardioides*)
- Downy rose myrtle** (*Rhodomyrtus tomentosa*)
- Japanese climbing fern** (*Lygodium japonicum*)
- Kudzu** (*Pueraria montana*)
- Small-leaved climbing fern** (*Lygodium microphyllum*)
- Sewer-vine** (*Paederia cruddasiana*)
- Skunk-vine** (*Paederia foetida*)
- Wetland nightshade** (*Solanum tampicense*)
- White yam** (*Dioscorea alata*)



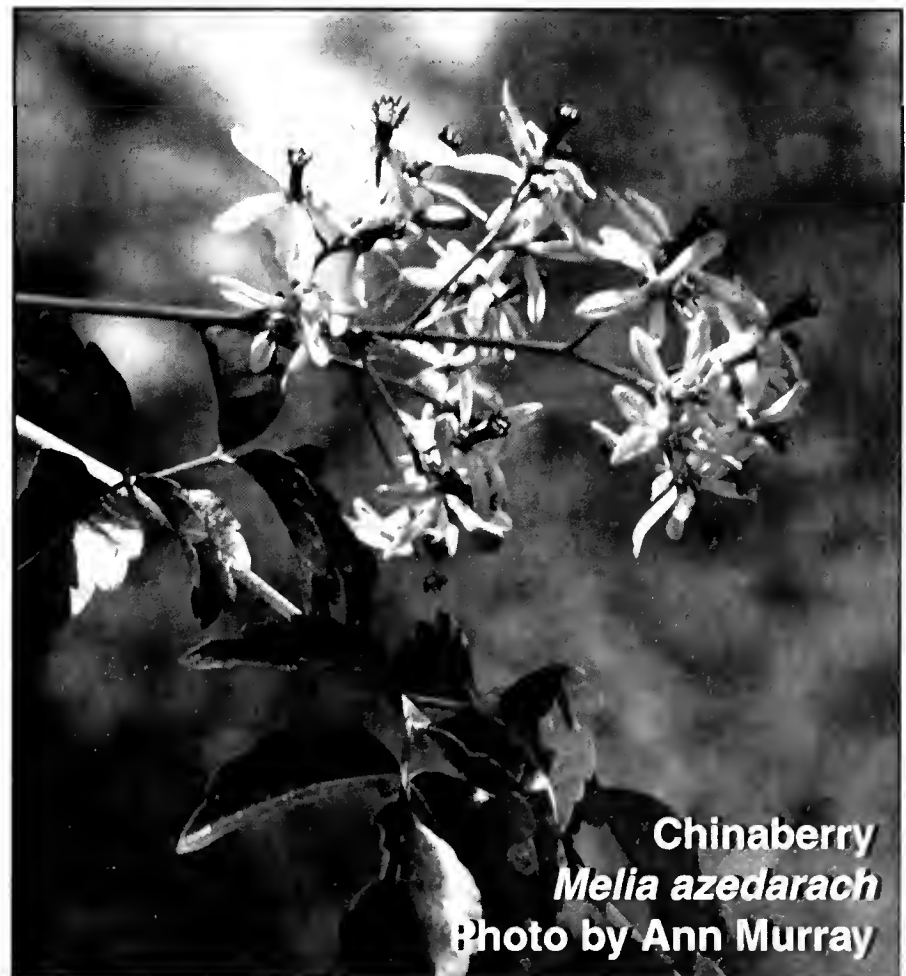
Carrotwood
Cupaniopsis anacardioides
Photo by Ann Murray

Nurserymen Give Up 11

The Florida Nurserymen and Growers Association (FNGA) has decided to encourage its members to voluntarily phase out the growing and selling of 11 species of plants identified as being invasive in Florida. The 11 came from a list of especially invasive plants as determined by the Florida Exotic Pest Plant Council (FLEPPC). The full list can be seen at <http://www.fleppc.org>. Ten of these plants are *not* officially banned by the state of Florida, carrotwood being the exception.

The 11 plants the nurserymen have agreed to phase out are:

- Woman's tongue** (*Albizia lebbek*)
- Orchid tree** (*Bauhinia variegata*)
- Bischofia** (*Bischofia javanica*)
- Carrotwood** (*Cupaniopsis anacardioides*)
- Cat's claw vine** (*Macfadyena unguis-cati*)
- Chinaberry** (*Melia azedarach*)
- Sword fern** (*Nephrolepis cordifolia*)
- Guava** (*Psidium guajava*)
- Oyster plant** (*Rhoeo spathacea*)
- Java plum** (*Syzygium cumini*)
- Seaside mahoe** (*Thespesia populnea*)



Chinaberry
Melia azedarach
Photo by Ann Murray

Other plants sold by nurseries, such as lantana, ardesia and nandina, also have been declared to be invasive by the FLEPPC. The nurserymen have not agreed to cease selling them. But that's another story.

Books/Reports

PLANT INVASIONS -- Studies from North America and Europe, edited by J.H. Brock, M. Wade, P. Pysek and D. Green. 1997. 224 pp.

(Order from Backhuys Publishers, POB 321, 2300 AH Leiden, The Netherlands. US\$52.75 plus S/H. Email: backhuys@euronet.nl WWW: <http://www.euronet.nl/users/backhuys>)

"When an alien plant(s) overtakes the native vegetation and essentially develops a monoculture, it can be said that the environment of that area has changed... Management attempts that extol eradication of these alien species most likely will be futile... Existing vegetation management tools will effectively control alien invasive plants if there is both the political and social consensus for vegetation management." Included are 19 papers on various invasive plants in the U.S. and Europe written by scientists well-known for their work on invasive plants.

PLANT INVASIONS -- Ecological Mechanisms and Human Responses, edited by U. Starfinger, K. Edwards, I. Kowarik and M. Williamson. 1998. 362 pp.

(Order from Backhuys Publishers, POB 321, 2300 AH Leiden, The Netherlands. US\$97.00 plus S/H. Email: backhuys@euronet.nl WWW: <http://www.euronet.nl/users/backhuys>)

"Adventive floristics" is a term from the 19th century which refers to plant invasion studies. Although "non-native plant invasions" only recently have become important environmental news in the United States, Europeans have much experience in their study. This volume includes papers presented at the 4th International Conference on the Ecology of Invasive Alien Plants, 1-4 October 1997, in Berlin. Twenty-two of the chapters are case studies of invasive species, from Russian olive invasion of Arizona to the invasion of *Impatiens glandulifera* in Poland; from the invasion of North American blueberry hybrids in Germany to the spread of a tropical alga in the Mediterranean Sea. Several essays about aspects of plant invasions also are included.

EXOTIC PESTS OF EASTERN FORESTS, edited by K.O. Britton. 1997. 198 pp.

This is the proceedings of the Exotic Pests of Eastern Forests Conference, Nashville, Tennessee, April 8-10, 1997. Papers discussing exotic plants, insects and diseases are presented, forming a basic overview of the exotic species threat in the United States, and who, in 1997, were doing something about it.

HARMFUL ALGAE, edited by B. Reguera, J. Blanco, M.L. Fernandez and T. Wyatt. 1998. 635 pp.

(Order from Centre on Harmful Algae, Instituto Espanol de Oceanografia, Centro Oceanografico de Vigo, aptdo 1552 Vigo, 36080 Pontevedra, Spain. E-mail: vigohab@vi.ieo.es)

This is the (huge) proceedings of the VIII International Conference on Harmful Algae, Vigo, Spain, June 25-29, 1997. It includes many scientific descriptions of harmful algae events such as toxic blooms of cyanobacteria; ciguatera dinoflagellates; shellfish killers PSP, DSP and ASP; and fish killing and manatee killing algae such as *Gymnodinium breve*. Included are other large sections on population dynamics and ecology of harmful algae; their monitoring and management; their taxonomy and identification; their toxin production and degradation; their interactions with other organisms; the uptake and biotransformation of toxins by shellfish; toxin descriptions and detection methods; and the toxic mechanisms of the algae.

THE BIOLOGY OF STREAMS AND RIVERS, by P.S. Giller and B. Malmqvist. 1998. 296 pp.

(Order from Oxford University Press, 198 Madison Avenue, New York, NY 10016-4314. Cloth: \$85 plus S/H Paperback: \$35 plus S/H)

This book, a comprehensive overview written as an undergraduate text, provides more than a glimpse of the life below the water surface of streams and rivers. It "delves into the rich and growing literature and provides an up-to-date introduction to stream and river biology." The authors describe the different kinds of watercourses;

outline the range of living organisms of rivers, and their adaptations; discuss population, community and ecosystem patterns and processes such as energy flow and secondary production; and discuss applied issues such as the effects of pollution, tourism, sport fishing and exotic species.

STONEWORKS--Valuable for Water Management, by M.S. Van den Berg and H. Coops. 1999. 40 pp.

(Order from Harry Hosper, RIZA, POB 17, NL-8200 AA Lelystad, The Netherlands.)

It is well known that water plants make water clear. Even in very nutrient rich lakes, where the water is generally murky green with free-floating algae, the water may be crystal clear within and above submersed plant beds. In this book, Dutch researchers compare the underwater stoneworts, such as *Chara* species, with other species to identify plants which might keep the water clear, but which at the same time would cause relatively little nuisance to swimmers, skiers and boaters. They found that the stoneworts have a "particularly great effect on the surrounding waters", having "a major influence on the clarity of the water." Stoneworts also benefit animals, especially birds, fish and amphibians. The message: selectively manage for stoneworts.

LIVING AT THE LAKE -- A Handbook for Florida Lakefront Property Owners, by M. Bachmann, M. Hoyer and D.E. Canfield, Jr. 1999. 182 pp.

(Order from IFAS Publications, POB 110011, Gainesville, FL 32610-0011. (800) 226-1764. \$15.00 plus S/H.)

A book long needed in Florida, this is "the definitive introduction to lakeside living." It includes information on selecting lakeside property for specific needs and lifestyles; real-English explanations of government rules and regs; an introduction to lake plants and animals; information about the numerous federal and state agencies -- information and inspiration for those who live (or who want to live) on one of Florida's 7,000 lakes.

HUDSON RIVER FIELD GUIDE TO PLANTS OF FRESHWATER TIDAL WETLANDS, by New York State Department of Environmental Conservation, illustrated by L.B. McCloskey. 1998. 50 pp.

(Order from Hudson River National Estuarine Research Reserve, c/o Bard College Field Station, Annandale, NY 12504. (914) 758-7010.)

Meant for weekend marsh explorers, this very beautifully illustrated handbook treats 4 submersed, 1 floating, and 18 emerged plants of the tidal Hudson River. The line drawings illustrate how the plants appear in different stages throughout the year, and in many cases include microscopic enlargements of important features. Text for each plant briefly notes distinctive characteristics and habitat. As nice as the book is, the best part is that apparently it is free of charge.

ATLAS OF RUSSIAN WETLANDS--Biogeography and Metal Concentrations, by A.V. Zhulidov, J.V. Headley, R.D. Robarts, A.M. Nikanorov and A.A. Ischenko. 1997. 309 pp.

(Order from Dr. Richard D. Robarts, National Water Research Institute, Environment Canada, 11 Innovation Blvd., Saskatoon, SK, CANADA S7N 3H5. E-mail: richard.robarts@ec.gc.ca)

This clearly written, carefully produced, well indexed, good looking and easy-to-follow large-format book is a "comprehensive compilation of wetland ecosystems of 13 major ecological regions of Russia that extend from polar to subtropical regions and across some 6,500 km from Europe to the Pacific Ocean," and includes detailed summaries of their topographical, hydrological, climatic, and surface water and wetland features. Maps, tables and photographs abound.

THE BIOLOGY OF LAKES AND PONDS, by C. Bronmark and L. Hansson. 1998. 216 pp.

(Order from Oxford University Press, 198 Madison Avenue, New York, NY 10016. \$35.00 paper; \$85.00 cloth.)

This is an introductory text to aquatic ecology and limnology. Though the book is by two Swedish researchers, the focus is on "the general patterns in adaptations and processes among organisms of lakes and ponds", patterns which apply to lakes throughout the world. The authors especially seek to present "what we think is interesting and important to know for an aquatic ecologist at the beginning of his or her career." Chapters include "The abiotic frame and adaptations to cope with abiotic constraints"; "The organisms: the actors within the abiotic frame"; "Biotics: competition, herbivory, predation, parasitism, and symbiosis"; "Food web interactions in freshwater ecosystems"; and "Environment and conservation".

THE HUMANURE HANDBOOK, by J. Jenkins. 1999. 305 pp.

(Order from Chelsea Green Publishing, POB 428, White River Junction, VT 05001. (800) 639-4099.)

Another Y2K worry: what to do if the toilets don't flush. First of all, according to the author, an organic gardener, human excrement is not a waste material, it's a resource material. Beginning with an essay on wasteful humans, this treatise on human waste eventually tells us what to do if and when the Y2K bug backs up your toilet. Or if and when you decide to start using this valuable resource. Suffice to say this is a mature discussion about "composting humanure, an act of humility". If you're into it, and have the time and the acreage, this book is full of detailed and scientific answers on what to do, a well-written and entertaining manual.

INVASIVE PLANTS - Changing the Landscape of America - Fact Book, by R.G. Westbrooks and the Federal Interagency Committee for the Management of Noxious and Exotic Weeds. 1998. 107 pp.

(Order from U.S. Department of Agriculture, Natural Resources Conservation Service, Plant Materials Center, 14119 Broad Street, Brooksville, FL 34601. (352) 796-9600.)

This large format, glossy color book begins with essays on "understanding the problem" of invasive plants. It then describes invasive plants in more than a dozen different situations, croplands to private preserves. This is certainly not an identification manual (no morphological descriptions, too-small pictures...); rather, each plant is described in terms of ecologic and economic impacts as weeds in the United States. Lots of facts!

USE WATER HYACINTH! A Practical Handbook of Uses for the Water Hyacinth from Across the World, by K. Lindsey and H.-M. Hirt. 1999. 115 pp.

(Order from Anamed, Schafweide 77, 71364 Winnenden, Germany. E-mail: keith_lindsey@hotmail.com. \$15 plus S/H.)

Lake Victoria, Africa, has 10,000 hectares of water hyacinths, "an immediate catastrophe." The authors state, "There are strong pressures and voices for and against the use of chemicals. It is imperative that alternatives are found....Conventional voices propose utilization as being merely ancillary to the real task of control, which must be tackled by chemical, biological or mechanical means. We disagree." Regarding chemical control of water hyacinths by 2,4-D and glyphosate, the authors state: "Chemical control is rapid and effective. It is also costly and environmentally disastrous."

The book presents good descriptions of water hyacinth, its growth, problems it creates and its control, and a good history of its spread. It also presents descriptions of how to use water hyacinth to produce compost, hay and silage; pig, rabbit and fish food; rope, crafts and furniture; briquettes and biogas; paper and boards; and building materials. The book includes a listing of several organizations and companies which are said to produce things from water hyacinths.

SIGNIFICANT HABITATS AND HABITAT COMPLEXES OF THE NEW YORK BIGHT WATERSHED, by the U.S. Fish and Wildlife

Service, Southern New England-New York Bight Coastal Ecosystems Program. 1997. CD-ROM.

(Order by E-mail: r5es_snenybcep@mail.fws.gov Free.)

This 1,025-page study of the New York Bight watershed (20 million acres or 31,000 sq. miles) "focuses on the identification and description of essential habitats of key marine, coastal and terrestrial species inhabiting the watershed study area in order to help guide informed and ecologically sound land use decisions and land protection efforts." Over 1,000 species of special emphasis are identified, including invertebrates, fish, amphibians, reptiles, birds, mammals and plants. Eighty-two natural communities also are described. This work is filled with lists, descriptions and maps. Strangely, authors are not identified either for the entire work, or for parts of it.

EVALUATION OF MACROPHYTE CONTROL IN 41 FLORIDA LAKES USING TRIPLOID GRASS CARP (*CTENOPHARYNGODON IDELLA*) AT DIFFERENT STOCKING RATES, by S.G. Hanlon. Master's Thesis. University of Florida. 1999. 113 pp.

(Order from Dissertation Abstracts International, Ann Arbor, Michigan.)

"The use of grass carp can be an effective and economical control for aquatic vegetation such as hydrilla. Early stocking rates (24 to 74 grass carp per hectare of lake area) resulted in grass carp consumption rates that vastly exceeded the growth rates of the aquatic plants and often resulted in the total loss of all submersed vegetation. This study looked at 41 Florida lakes that had been stocked with grass carp for 3 to 10 years with stocking rates ranging from 1 to 60 grass carp per hectare to determine the long term effects of grass carp on macrophyte communities... If the management goal for a lake is to control some of the problem aquatic plants while maintaining a small population of predominately unpalatable aquatic plants, grass carp can be stocked at approximately 8 to 10 fish per hectare."

THE PRODUCTION ECOLOGY OF WETLANDS: THE IBP SYNTHESIS, edited by D.F. Westlake, J. Kvet and A. Szczepanski. 1998. 568 pp.

(Order from Cambridge University Press, 40 West 20 ST, New York, NY 10011-4211. \$130 plus S/H.)

In this book, "A wetland is an area dominated by herbaceous macrophytes, which photosynthesize predominantly in the aerial environment and root in a soil which, generally speaking, is entirely saturated with water throughout the greater part of the growing season."

According to the editors, this book differs from other recent books on wetlands in that it "accentuates the roles of biological components and processes in the structure and functioning of wetland ecosystems"; it "concentrates on wetlands of lakes, rivers and fens, which are often relatively alkaline or only slightly acid"; it assesses the ways in which wetland plants interact with microbes and animals through detritus, grazing, and creation of micro-habitats; and the book pays special attention to the structure of wetland plants, mineral cycling, micro-climates and water relations. Book chapters include: General ecology of wetlands; Primary production in wetlands; Further fate of organic matter in wetlands; The role of decomposers in wetlands; The role of animals and animal communities in wetlands; Mineral economy and cycling of minerals in wetlands; Micro-climatic conditions and water economy of wetland vegetation; and The management of wetlands.

BRINGING BACK THE WETLANDS, by B. Streever. 1999. 215 pp.

(Order from Sainty & Associates, POB 1219, Potts Point, NSW Australia 1335. \$19.95 plus S/H.)

This is a "novel styled book about the people who work on wetlands, based on the work at Kooragang Island, plus world wide anecdotes." The story is true; names have been changed. It's really a documentary.

THE RIVER VALLEYS OF THE MALTESE ISLANDS --Environment and Human Impact, by S.M. Haslam and J. Borg. 1998. 330 pp.

(To order, contact Dr. S.M. Haslam, Department of Plant Sciences, University of Cambridge, Downing Street, Cambridge CB2 3EA, GREAT BRITAIN)

Only two centuries ago Malta had hundreds of kilometers of active rivers; now most of them are dried up "beds" of brambles and grasses: river valleys and walled river channels with no or very little water. What happened? This book is a "landmark in the appreciation and understanding of the natural and cultural environment" of the Maltese Islands, the island nation in the center of the Mediterranean Sea. The book is filled with maps, pictures and drawings to demonstrate what has happened.

According to the authors, demand from agriculture and population growth; draining marshes for farming and, later, for disease control; and run-off via roads into the sea has diverted and otherwise used up the spring and rain water that used to create Maltese rivers. Unless lessons are learned from these islands, the authors ask if people one day will say, "England has no rivers."

IDENTIFICATION AND BIOLOGY OF NON-NATIVE PLANTS IN FLORIDA'S NATURAL AREAS, edited by K.A. Langeland and K. Craddock Burks. University of Florida. 1999. 165 pp.

(Order from IFAS Publications, POB 110011, Gainesville, FL 32611; 1-800-226-1764. \$16.00 plus S/H.)

So far as **APIRS** is aware, this is one of only two identification manuals devoted exclusively to non-native invasive plants. This book treats 62 species, giving synonymy and botanical descriptions as well as sections on distribution and life history, and includes referenced information about each plant's history of introduction and its impact on native ecosystems. Most of the photos are larger-than-usual for similar ID manuals, a welcome improvement.

MEETINGS

9TH ANNUAL SOUTHEASTERN LAKES MANAGEMENT CONFERENCE.

March 22-25, 2000. Columbus, Georgia.

This year's theme: Protecting Lakes and Watersheds: Innovative Solutions to Point and Non-Point Source Pollution. This conference is for the exchange of ideas on restoring, enhancing and preserving watersheds, lakes and reservoirs in the Southeast U.S.

Contact: WWW: <http://www.nalms.org>

19TH ANNUAL SYMPOSIUM, NORTH AMERICAN LAKE MANAGEMENT SOCIETY.

December 1-4, 1999. Reno, Nevada.

This year's theme: Water: 21st Century Gold. The symposium will "highlight water issues and provide the technical guidance required to intelligently manage our aquatic resources into the future." It will include presentations, commercial exhibits and pre-and post-conference workshops.

Contact: WWW: <http://www.nalms.org>

PREDICTING PLANT AND ANIMAL OCCURRENCES: ISSUES OF SCALE AND ACCURACY.

October 19-22, 1999. Snowbird, Utah.

This is an international conference to bring together scientists and land managers involved with habitat modeling, with "a focus on the future of modeling to support multi-scale landscape planning efforts for wildlife conservation and management." Abstracts should be submitted by 15 October, 1998. Manuscripts will be peer reviewed and published as a book.

Contact: WWW: http://www.ets.uidaho.edu/coop/1999_symposium.htm ; or contact Mr. Mike Scott (208) 885-6960; Dr. Patricia Heglund (208) 885-2665; or Ms. Kathy Merk (208) 885-2750.

MARKETING & SHIPPING LIVE AQUATIC PRODUCTS '99.

November 14-17, 1999. Seattle, Washington.

"Technological refinements are revitalizing the centuries old practice of providing live aquatic products for display or consumption far from the point of harvest...This conference will assist fishermen, growers and marketers of aquatic products to supply the expanding market while complying with increased restrictions and regulations." Major topics include: resources, shipping, harvesting, physiology, exotics, holding, reconditioning, regulations, packaging, water quality, marketing, research, and environmental, sociological, political and humanitarian considerations.

Contact: Conference Manager, John B. Peters, Nor'Westerly Food Technology Services, 20455 - 1st Ave. NE, Suite C 303, Poulsbo, WA 98370-9329. E-mail: johnbpeters@compuserve.com

27TH ANNUAL MEETING, ECOSYSTEMS RESTORATION AND CREATION.

May 11-12, 2000. Tampa, Florida.

This is a national forum for the exchange of results of scientific research in the restoration, creation and management of freshwater and coastal wetland systems, as well as upland systems. Topics include freshwater and marine wetland systems; uplands systems; marsh, mangrove and seagrass restoration; upland and mixed ecosystem restoration; mitigation, permitting and regulatory policies; mine reclamation; and management techniques.

Contact: F.J. Webb, Hillsborough Community College, Plant City Campus, 1206 N. Park Road, Plant City, FL 33566. (813) 757-2148; E-mail: webb@mail.hcc.cc.fl.us

WETLANDS AND REMEDIATION: AN INTERNATIONAL CONFERENCE.

November 16-17, 1999. Salt Lake City, Utah.

A conference to "bring together wetlands and remediation experts to discuss common issues." Fifty presentations and 60 posters. A proceedings volume will be published. High registration fees.

Contact: WWW: <http://www.battelle.org/environment/cr/wetconf.html> or contact Karl Nehring, Battelle Memorial Institute, E-mail: nehringk@battelle.org; (614) 424-6510.

FROM THE DATABASE

Here is a sampling of the research articles, books and reports which have been entered into the aquatic plant database since January 1999.

The database has more than 49,000 citations. To receive free bibliographies on specific plants and/or subjects, contact APIRS using the information on the back page or use the database online at <http://plants.ifas.ufl.edu/>

To obtain articles, contact your nearest state or university library.

Behnke, H-D.

Proliferating sieve elements present in bud phloem anastomoses connect sieve tubes of axillary bud traces to stelar vascular bundles in the aquatic monocotyledon *Potamogeton natans* L. (Potamogetonaceae). *PROTOPLASMA* 201:17-29. 1998.

Bekker, R.M., Knevel, I.C., Tallowin, J.B.R., Troost, E.M.L., et al

Soil nutrient input effects on seed longevity: a burial experiment with fen-meadow species. *FUNCTIONAL ECOL.* 12(4):673-682. 1998.

Berghage, R.D., MacNeal, E.P., Wheeler, E.F., Zachritz, W.H.

"Green" water treatment for the green industries: opportunities for biofiltration of greenhouse and nursery irrigation water and runoff with constructed wetlands. *WETLANDS AND HORTICULTURE: PROBLEMS AND SOLUTIONS, HORTSCIENCE* 34(1):50-54. 1999.

Biehle, G., Speck, T., Spatz, H-CH.

Hydrodynamics and biomechanics of the submerged water moss *Fontinalis anti-pyretica* - a comparison of specimens from habitats with different flow velocities. *BOT. ACTA* 111:42-50. 1998.

Bjork, M., Weil, A., Semesi, S., Beer, S.

Photosynthetic utilization of inorganic carbon by seagrasses from Zanzibar, East Africa. *MAR. BIOL.* 129(2):363-366. 1997.

Bonar, S.A., Bolding, B., Divens, M.

Management of aquatic plants in Washington State using grass carp: effects on aquatic plants, water quality and public satisfaction 1990-1995. *INLAND FISH DIV. RES., WASHINGTON DEPT. FISH & WILDL., OLYMPIA, WA*, 28 PP. 1996.

Boniardi, N., Rota, R., Nano, G.

Effect of dissolved metals on the organic load removal efficiency of *Lemna gibba*. *WAT. RES.* 33(2):530-538. 1999.

Bolser, R.C., Hay, M.E., Lindquist, N., Fenical, W., et al

Chemical defenses of freshwater macrophytes against crayfish herbivory. *J. CHEM. ECOL.* 24(10):1639-1658. 1998.

Bunn, S.E., Davies, P.M., Kellaway, D.M., Prosser, I.P.

Influence of invasive macrophytes on channel morphology and hydrology in an open tropical lowland stream, and potential control by riparian shading. *FRESHWATER BIOL.* 39:171-178. 1998.

Burdick, D.M., Short, F.T.

The effects of boat docks on eelgrass beds in coastal waters of Massachusetts. *ENVIRONMENTAL MANAGEMENT* 23(2):231-240. 1999.

Cavan, G., Biss, P., Moss, S.R.

Localized origins of herbicide resistance in *Alopecurus myosuroides*. *WEED RES.* 38:239-245. 1998.

Chendorain, M., Yates, M., Villegas, F.

The fate and transport of viruses through surface water constructed wetlands. *J. ENVIRON. QUAL.* 27(6):1451-1458. 1998.

Chung, Y.R., Koo, S.J., Kim, H.T., Cho, K.Y.

Potential of an indigenous fungus, *Plectosporium tabacinum*, as a myco-herbicide for control of arrowhead (*Sagittaria trifolia*). *PLANT DISEASE* 82(6):657-660. 1998.

Colton, T.F., Alpert, P.

Lack of public awareness of biological invasions by plants. *NATURAL AREAS J.* 18(3):262-266. 1998.

Costa-Pierce, B.A.

Preliminary investigation of an integrated aquaculture-wetland ecosystem using tertiary-treated municipal wastewater in Los Angeles County, California. *ECOL. ENGINEERING* 10:341-354. 1998.

Cronin, G., Wissing, K.D., Lodge, D.M. Comparative feeding selectivity of herbivorous insects on water lilies: aquatic vs. semi-terrestrial insects and submersed vs. floating leaves. *FRESHWATER BIOL.* 39:243-257. 1998.

Daehler, C.C., Anttila, C.K., Ayres, D.R., Strong, D.R., et al

Evolution of a new ecotype of *Spartina alterniflora* (Poaceae) in San Francisco Bay, California, USA. *AMER. J. BOT.* 86(4):543-546. 1999.

Dickinson, M.B., Miller, T.E.

Competition among small, free-floating, aquatic plants. *AMER. MIDL. NATURALIST* 140(1):55-67. 1998.

Douglas, G.W., Illingworth, J.M.

Status of the water-plantain buttercup, *Ranunculus alismifolius* var. *alismifolius* (Ranunculaceae) in Canada. *CANADIAN FIELD-NATURALIST* 112(2):280-283. 1998.

Duffy, K.C., Baltz, D.M.

Comparison of fish assemblages associated with native and exotic submerged macrophytes in the Lake Pontchartrain estuary, USA. *J. EXP. MAR. BIOL. ECOL.* 223(2):199-221. 1998.

Edwards, E.S., Roux, S.J.

Gravity and light control of the developmental polarity of regenerating protoplasts isolated from prothallial cells of the fern *Ceratopteris richardii*. *PLANT CELL REPORTS* 17:711-716. 1998.

Ennabili, A., Ater, M., Radoux, M.

Biomass production and NPK retention in macrophytes from wetlands of the Tingitan peninsula. *AQUATIC BOTANY* 62:45-56. 1998.

Evers, D.E., Sasser, C.E., Gosselink, J.G., Fuller, D.A., et al

The impact of vertebrate herbivores on wetland vegetation in Atchafalaya Bay, Louisiana. *ESTUARIES* 21(1):1-13. 1998.

Fairchild, J.F., Ruessler, D.S., Carlson, A.R.

Comparative sensitivity of five species of macrophytes and six species of algae to atrazine, metribuzin, alachlor, and metolachlor. *ENVIR. TOXICOL. CHEM.* 17(9):1830-1834. 1998.

Fraga, J.M.P., Quesada, E.M.

Structure of *Eleocharetum interstinctae* in Santa Cruz Reservoir, Cuba.
 ACTA BOT. HUNGARICA 39(3-4):217-226. 1995.

Frenzel, P., Rudolph, J.

Methane emission from a wetland plant: the role of CH₄ oxidation in *Eriophorum*.
 PLANT AND SOIL 202:27-32. 1998.

Furtado, A.L.D.S., Esteves, F.D.A.

Organic compounds, nutrients and energy of two tropical aquatic macrophytes.
 ARQ. BIOL. TECNOL. 39(4):923-931. 1996.

Gann, G., Gordon, D.R.

Paederia foetida (Skunk vine) and *P. cruddasiana* (Sewer vine): threats and management strategies.
 NAT. AREAS J. 18(2):169-173. 1998.

Gawlik, D.E., Rocque, D.A.

Avian communities in bayheads, willowheads, and sawgrass marshes of the central Everglades.
 WILSON BULL. 110(1):45-55. 1998.

German, E.R.

Evapotranspiration measurement and modeling in the Everglades.
 IN: U.S. GEOLOGICAL SURVEY PROG., SO. FLORIDA ECOSYSTEM - PROC. SO. FLORIDA RESTORATION SCIENCE FORUM, 17-19 MAY 1999, BOCA RATON, FL, USGS OPEN-FILE REPT. 99-181, PP. 24-25 (ABSTRACT) 1999.

Gornall, R.J., Hollingsworth, P.M., Preston, C.D.

Evidence for spatial structure and directional gene flow in a population of an aquatic plant, *Potamogeton coloratus*.
 HEREDITY 80:414-421. 1998.

Gupta, M., Chandra, P.

Bioaccumulation and toxicity of mercury in rooted-submerged macrophyte *Vallisneria spiralis*.
 ENVIRON. POLLUTION 103(2-3):327-332. 1998.

Hansen, D., Duda, P.J., Zayed, A., Terry, N.

Selenium removal by constructed wetlands: role of biological volatilization.
 ENVIRON. SCI. TECHNOL. 32:591-597. 1998.

Hester, M.W., Mendelssohn, I.A., McKee, K.L.

Intraspecific variation in salt tolerance and morphology in *Panicum hemitomon* and *Spartina alterniflora* (Poaceae).
 INT. J. PLANT SCI. 159(1):127-138. 1998.

Hill, N.M., Keddy, P.A., Wisheu, I.C.

A hydrological model for predicting the effects of dams on the shoreline vegetation of lakes and reservoirs.
 ENVIRON. MANAGE. 22(5):723-736. 1998.

Horvitz, C.C., Pascarella, J.B., McMann, S., Freedman, A., et al

Functional roles of invasive non-indigenous plants in hurricane-affected subtropical hardwood forests.
 ECOLOGICAL APPLICATIONS 8(4):947-974. 1998.

Husak, S., Adamec, L.

Conservation cultivations of endangered aquatic and wetland plant species in the Institute of Botany in Trebon.
 PRIRODA, PRAHA 12:7-26. 1998. (IN CZECH, ENGLISH SUMMARY)

Jackson, B., Summers, J.E., Voeselek, L.A.C.J.

Potamogeton pectinatus: a vascular plant that makes no ethylene.
 IN: BIOLOGY AND BIOTECHNOLOGY OF THE PLANT HORMONE ETHYLENE, ED. BY A.K. KANELIS, ET AL, KLUWER ACAD. PUBL., PP. 229-237. 1997.

Jackson, S.T.

Documenting natural and human-caused plant invasions using paleoecological methods.
 IN: ASSESSMENT AND MANAGEMENT OF PLANT INVASIONS, ED. BY J.O. LUKEN AND J.W. THIERET, SPRINGER-VERLAG, NEW YORK, PP. 37-55. 1997.

Jacobsen, L., Perrow, M.R.

Predation risk from piscivorous fish influencing the diel use of macrophytes by planktivorous fish in experimental ponds.
 ECOL. FRESHWATER FISH 7:78-86. 1998.

Janse, J.H., Van Donk, E., Aldenberg, T.

A model study on the stability of the macrophyte-dominated state as affected by biological factors.
 WATER RES. 32(9):2696-2706. 1998.

Jenman, B., Kitchin, C.

A comparison of the management and rehabilitation of two wet grassland nature reserves: the Nene Washes and Pevensy Levels, England.
 IN: EUROPEAN WET GRASSLANDS: BIODIVERSITY, MANAGEMENT AND RESTORATION, ED. BY C.B. JOYCE AND P.M. WADE, JOHN WILEY & SONS, NEW YORK, PP. 229-245. 1998.

Jimenez, M.M., Charudattan, R.

Survey and evaluation of Mexican native fungi for potential biocontrol of

waterhyacinth.

J. AQUATIC PLANT MANAGE. 36:148-150. 1998.

Kadono, Y.

Present status of wetland flora in Japan, with special reference to aquatic macrophytes.
 IN: RARE, THREATENED, AND ENDANGERED FLORAS OF ASIA AND THE PACIFIC RIM, ED. BY C.-I. PENG, P.P. LOWRY, INST. BOT., ACADEMIA SINICA MONOGRAPH, TAIPEI, SERIES NO. 16, PP. 27-36. 1998.

Kaenel, B.R., Matthaei, C.D., Uehlinger, U.

Disturbance by aquatic plant management in streams: effects on benthic invertebrates.
 REGUL. RIVERS: RES. MGMT. 14(4):341-356. 1998.

Kanazawa, A., Watanabe, S., Nakamoto, T., Tsutsumi, N., et al

Phylogenetic relationships in the genus *Nelumbo* based on polymorphism and quantitative variations in mitochondrial DNA.
 GENES GENET. SYST. 73:39-44. 1998.

Kane, M.E., Philman, N.L.

In vitro propagation and selection of superior wetland plants for habitat restoration.
 IN: COMBINED PROC. INTERN'L. PLANT PROPAGATORS' SOC. 47:556-560. 1997.

Kaplan, D., Peters, G.A.

The *Azolla-Anabaena azollae* relationship. XIV. Chemical composition of the association and soluble carbohydrates of the association, endophyte-free *Azolla*, and the freshly isolated endophyte.
 SYMBIOSIS 24:35-50. 1998.

Karen, D.J., Joab, B.M., Wallin, J.M., Johnson, K.A.

Partitioning of chlorpyrifos between water and an aquatic macrophyte (*Elodea densa*).
 CHEMOSPHERE 37(8):1579-1586. 1998.

Kasumi, M., Sakuma, F.

Flowering, pollination, fertilization, and seed formation in lotus rhizome plant.
 J. JAPAN. SOC. HORT. SCI. 67(4):595-599 (IN JAPANESE; ENGLISH SUMMARY). 1998.

Kitajima, K.

Coral ardisia (*Ardisia crenata*) differences in ecological behavior between populations in Florida and its native range in Japan.
 IN: FOURTEENTH ANNUAL CONF., FLORIDA EXOTIC PEST PLANT COUNCIL, GAINESVILLE, P. 10 (ABSTRACT) 1999.

Leeftang, L., During, H.J., Werger, M.J.A.

The role of petioles in light acquisition by *Hydrocotyle vulgaris* L. in a vertical light gradient.

OECOLOGIA 117(1-2):235-238. 1998.

Lesica, P., Kannowski, P.B.

Ants create hummocks and alter structure and vegetation of a Montana fen.

AMER. MIDL. NAT. 139:58-68. 1998.

Liu, Q., Oelke, E.A., Porter, R.A., Reuter, R.

Formation of panicles and hermaphroditic florets in wild-rice.

INT. J. PLANT SCI. 159(4):550-558. 1998.

Lonsdale, W.M., Farrell, G.S.

Testing the effects on *Mimosa pigra* of a biological control agent *Neurostrota gunniella* (Lepidoptera: Gracillariidae), plant competition and fungi under field conditions.

BIOCONTROL SCI. TECHNOL. 8(4):485-500. 1998.

Lytle, C.M., Lytle, F.W., Yang, N., Quian, J., et al

Reduction of Cr(VI) to Cr(III) by wetland plants: potential for *in situ* heavy metal detoxification.

ENVIRON. SCI. TECHNOL. 32(20):3087-3093. 1998.

Maberly, S.C., Madsen, T.V.

Affinity for CO₂ in relation to the ability of freshwater macrophytes to use HCO₃.

FUNCTIONAL ECOL. 12:99-106. 1998.

Madsen, J.D.

Predicting the invasion of Eurasian watermilfoil into northern lakes.

AQUATIC PLANT CONTROL RESEARCH PROGRAM, U.S. ARMY CORPS OF ENGINEERS, WATERWAYS EXPT. STN., TECH. REPT. A-99-2, 36 PP. 1999.

Matsuki, T., Negishi, H., Fujimori, T.

Mycelial preparation of *Nimbya scirpicola* for biological control of *Eleocharis kuroguwai* Ohwi.

J. PESTICIDE SCI. 23(3):312-315. 1998.

Miller, S.J., Ponzio, K.J., Lee, M.A., Keenan, L.W., et al

The use of fire in wetland preservation and restoration: are there risks?

IN: FIRE IN ECOSYSTEM MANAGEMENT: SHIFTING THE PARADIGM FROM SUPPRESSION TO PRESCRIPTION, ED. BY T.L. PRUDEN, L.A. BRENNAN, TALL TIMBERS FIRE ECOL. CONF. PROC. NO. 20, TALL TIMBERS RESEARCH STATION, TALLAHASSEE, FL, PP. 127-139. 1998.

Mitsch, W.J., Wise, K.M.

Water quality, fate of metals, and predictive model validation of a constructed wetland treating acid mine drainage.

WAT. RES. 32(6):1888-1900. 1998.

Miyazawa, M., Yoshio, K., Ishikawa, Y., Kameoka, H.

Insecticidal alkaloids against *Drosophila melanogaster* from *Nuphar japonicum* DC.

J. AGRIC. FOOD CHEM. 46(3):1059-1063. 1998.

Murugesan, A.G., Sukumuran, N.

Potential utilization of aquatic weeds for treating industrial effluents.

IN: LIMNOLOGICAL RESEARCH IN INDIA, S.R. MISHA, ED., DAYA PUBL. HOUSE, DELHI, PP. 247-259. 1999.

Obataya, E., Umezawa, T., Nakatsubo, F., Norimoto, M.

The effects of water soluble extractives on the acoustic properties of reed (*Arundo donax* L.)

HOLZFORSCHUNG 53(1):63-67. 1999.

Olson, M.H., Carpenter, S.R., Cunningham, P., Gafny, S., et al

Managing macrophytes to improve fish growth: a multi-lake experiment.

FISHERIES 23(2):6-11. 1998.

Oostermeijer, J.G.B., Luijten, S.H., Krenova, Z.V., Den Nijs, H.C.M.

Relationships between population and habitat characteristics and reproduction of the rare *Gentiana pneumonanthe* L.

CONSERV. BIOL. 12(5):1042-1053. 1998.

Pennings, S.C., Richards, C.L.

Effects of wrack burial in salt-stressed habitats: *Batis maritima* in a southwest Atlantic salt marsh.

ECOGRAPHY 21(6):630-638. 1998.

Pezeshki, S.R., Jugsujinda, A., DeLaune, R.D.

Responses of selected U.S. gulf coast marsh macrophyte species to oiling and commercial cleaners.

WATER, AIR, SOIL POLL. 107(1-4):185-195. 1998.

Phogat, B.S., Pandey, J.

Effect of water regime and weed control on weed flora and yield of transplanted rice (*Oryza sativa*).

INDIAN J. AGRONOMY 43(1):77-81. 1998.

Poovey, A.G., Kay, S.H.

The potential of a summer drawdown to manage monoecious hydrilla.

J. AQUATIC PLANT MANAGE. 36:127-130. 1998.

Quayyum, H.A., Mallik, A.U., Lee, P.F.

Allelopathic potential of aquatic plants associated with wild rice (*Zizania palustris*): I. Bioassay with plant and lake sediment samples.

J. CHEM. ECOL. 25(1):209-220. 1999.

Ramage, D.L., Schiel, D.R.

Reproduction in the seagrass *Zostera novazelandica* on intertidal platforms in southern New Zealand.

MARINE BIOL. 130:479-489. 1998.

Randall, K.

Creating a lush lawn in your aquarium.

THE AQUATIC GARDENER 11(5):130-134. 1998.

Rayachhetry, M.B., Van, T.K., Center, T.D.

Regeneration potential of the canopy-held seeds of *Melaleuca quinquenervia* in south Florida.

INT. J. PLANT SCI. 159(4):648-654. 1998.

Reusch, T.B.H.

Differing effects of eelgrass *Zostera marina* on recruitment and growth of associated blue mussels *Mytilus edulis*.

MAR. ECOL. PROG. SER. 167:149-153. 1998.

Ritter, N.P., Crow, G.E.

Myriophyllum quitense Kunth (Haloragaceae) in Bolivia: a terrestrial growth-form with bisexual flowers.

AQUATIC BOTANY 60:389-395. 1998.

Rodriguez, J.C.

Nutritive value of water hyacinth *Eichhornia crassipes* (Mart.) Solms in relation to utilization as forage.

ZOOT. TROP. 15(1):51-65. 1997.

Rolletschek, H., Bumiller, A., Henze, R., Kohl, J.G.

Implications of missing efflux sites on convective ventilation and amino acid metabolism in *Phragmites australis*.

NEW PHYTOL. 140(2):211-217. 1998.

Russell, R.C.

Constructed wetlands and mosquitoes: health hazards and management options - an Australian perspective.

ECOLOGICAL ENGINEERING 12:107-124. 1999.

Ruzycski, E.M., Axler, R.P., Owen, C.J., Martin, T.B.

Response of phytoplankton photosynthesis and growth to the aquatic herbicide Hydrothol 191.

ENVIRON. TOXICOL. CHEM. 17(8):1530-1537. 1998.

Saarinen, T.

Internal C:N balance and biomass partitioning of *Carex rostrata* grown at three levels of nitrogen supply.

CAN. J. BOT. 76(5):762-768. 1998.

Sabbatini, M.R., Murphy, K.J., Irigoyen, J.H.

Vegetation-environment relationships in irrigation channel systems of southern Argentina.

AQUATIC BOTANY 60:119-133. 1998.

Sekiranda, S.B.K., Kiwanuka, S.

A study of nutrient removal efficiency of *Phragmites mauritianus* in experimental reactors in Uganda.

HYDROBIOLOGIA 364(1):83-91. 1998.

Seymour, R.S., Schultze-Motel, P.

Physiological temperature regulation by flowers of the sacred lotus.

PHIL. TRANS. ROYAL SOC. LONDON, SER. B-BIOL. SCI. 353(1371):935-943. 1998.

Shrestha, P.

Diversity of aquatic macrophytes in the Koshi Tappu Wildlife Reserve and surrounding areas, eastern Nepal.

IN: ENVIRONMENT AND BIODIVERSITY: IN THE CONTEXT OF SOUTH ASIA, ED. BY P.K. JHA, G.P.S. GHIMIRE, S.B. KARMACHARYA, ET AL, ECOL. SOC. (ECOS), NEPAL, PP. 203-211. 1996.

Singh, D.P.

Performance of rice (*Oryza sativa*) as affected by intercropping with phosphorus-enriched *Azolla caroliniana* under varying levels of urea-nitrogen.

INDIAN J. AGRON. 43(1):13-17. 1998.

Spahn, P., Hoffmann, L.

Spatio-temporal development of the aquatic vegetation of the Alzette River (G.-D. of Luxembourg).

BELGIAN J. BOT. 131(1):3-12. 1998.

Spanglet, H.J., Ustin, S.L., Rejmankova, E.

Spectral reflectance characteristics of California subalpine marsh plant communities.

WETLANDS 18(3):307-319. 1998.

Stary, P., Tkalcu, B.

Bumble-bees (Hym., Bombidae) associated with the expansive touch-me-not, *Impatiens glandulifera* in wetland biocorridors.

ANZ. SCHADLINGSKDE., PFLANZENSCHUTZ, UMWELTSCHUTZ 71:85-87. 1998.

Tilley, D.R., Brown, M.T.

Wetland networks for stormwater management in subtropical urban watersheds.

ECOL. ENGINEERING 10:131-158. 1998.

Tyler, G.A., Smith, K.W., Burges, D.J.

Reedbed management and breeding bitterns *Botaurus stellaris* in the UK.

BIOL. CONSERV. 86(2):257-266. 1998.

Unmuth, J.M.L., Sloey, D.J., Lillie, R.A.

An evaluation of close-cut mechanical harvesting of Eurasian watermilfoil.

J. AQUATIC PLANT MANAGE. 36:93-100. 1998.

Van, T.K., Wheeler, G.S., Center, T.D.

Competitive interactions between *Hydrilla* (*Hydrilla verticillata*) and *Vallisneria* (*Vallisneria americana*) as influenced by insect herbivory.

BIOL. CONTROL 11(3):185-192. 1998.

Vanderpoorten, A.

Correlative and experimental investigations on the segregation of aquatic bryophytes as a function of water chemistry in the Walloon Hydrographic Network.

LEJEUNIA 159:1-17. 1999.

Vance, H.D., Francko, D.A.

Allelopathic potential of *Nelumbo lutea* (Willd.) Pers. to alter growth of *Myriophyllum spicatum* L. and *Potamogeton pectinatus* L.

J. FRESHWATER ECOL. 12(3):405-409. 1997.

Vermaat, J.E., Hanif, M.K.

Performance of common duckweed species (Lemnaceae) and the waterfern *Azolla filiculoides* on different types of waste water.

WAT. RES. 32(9):2569-2576. 1998.

Webb, C.J., Sykes, W.R.

The reinstatement of *Utricularia protrusa* for New Zealand and an assessment of the status of the other New Zealand bladderworts based on seed characters.

NEW ZEALAND J. BOT. 35(2):139-143. 1997.

White, S.L., Wise, R.R.

Anatomy and ultrastructure of *Wolffia columbiana* and *Wolffia borealis*, two nonvascular aquatic angiosperms.

INT. J. PLANT SCI. 159(2):297-304. 1998.

Whitt, M.B., Prince, H.H., Cox, R.R.

Avian use of purple loosestrife dominated habitat relative to other vegetation types in a Lake Huron wetland complex.

WILSON BULL. 111(1):105-114. 1999.

Williams, S.L., Orth, R.J.

Genetic diversity and structure of natural and transplanted eelgrass populations in the Chesapeake and Chincoteague Bays.

ESTUARIES 21(1):118-128. 1998.

Wojcicki, J.J., Bajzath, J.

Trapa praehungarica, a new fossil species from the Upper Pannonian of Hungary.

ACTA PALAEOBOT. 37(1):51-54. 1997.

Woodhead, J.L., Bird, K.T.

Efficient rooting and acclimation of micropropagated *Ruppia maritima* Loisel.

J. MAR. BIOTECHNOL. 6:152-156. 1998.

Yang, S.L.

The role of *Scirpus* marsh in attenuation of hydrodynamics and retention of fine sediment in the Yangtze estuary.

ESTUARINE, COASTAL AND SHELF SCI. 47(2):227-233. 1998.

Citations from 100 Years Ago...

Caldwell, O.W.

On the life history of *Lemna minor*.

BOT. GAZ. 27:37-66. 1899.

Ito, T.

Floating-apparatus of the leaves of *Pistia stratiotes* L.

ANN. BOT. 13:466. 1899.

Ladd, E.F.

Some chemical problems investigated.

I. A case of poisoning--water hemlock.

NORTH DAKOTA AGRIC. EXP. STN. BULL. 35:307-310. 1899.

Rendle, A.B.

A systematic revision of the genus *Najas*.

TRANS. LINN. SOC. BOT. 2(5):379-436. 1899.

Odds 'n' Ends

Giant salvinia (*Salvinia molesta*) is invading the United States, and has now been identified in Texas, Louisiana, Florida and Arizona. A biological agent, the beetle, *Cyrtobagous salviniae*, now is being evaluated for use against the dreaded aquatic weed to see if the beetle might be as successful against U.S. infestations as it has been elsewhere. Dr. Philip Tipping (USDA-ARS, Ft. Lauderdale) has begun distributing the beetle at sites in Louisiana and eastern Texas. Besides wanting to know about new infestations of giant salvinia, he also wants to find new sites of *Salvinia minima* where he finds natural populations of the salvinia beetle for collection and distribution. Dr. Tipping can be contacted at (954) 475-0541 X 104, or by E-mail: ptipping@eemail.com

The Weedo Grande River. Unhappy river users in Texas have complained to Texas Governor George W. Bush about the aquatic weed problems that occur on the Rio Grande River near Brownsville. Mr. Benny Berger has sent us pictures of the hydrilla and water hyacinth infestation, saying that citizens are disgusted and that the Border Patrol got their boat stuck in the plants. He states that the plants grow about 6" per day. Mr. Berger can be contacted at 36 River Bend Drive, Brownsville, TX 78520; E-mail: benber@pixelpiece.com

The Invasive Woody Plants in the Tropics Research Group, based at the University of Wales (Bangor, UK), has produced a global review of invasions, and has prepared a number of recommendations for management and control. Their web site includes papers on invading trees and case histories, as well as recommendations and contacts. <http://www.safs.bangor.ac.uk/iwpt>

The Hillsborough County (Florida) Lake Atlas is available online. This very well done, logically arranged web site presents an interactive map, a tour of Tampa-area lakes, lake management "volunteer opportunities", and Lakewatch data. Go to it: <http://www.lakeatlas.usf.edu>

The Estuarine Research Foundation is an "international organization whose purpose is to promote research in estuaries and coastal waters" and "be available as a source of advice in matters concerning estuaries and the coastal zone." Their web site is: <http://erf.org/>

Other new interesting photo and information features can be found at the Center for Aquatic and Invasive Plant web site. Particulars and photos of more than 150 plant species: <http://plants.ifas.ufl.edu/photos.html> *plus* Fakahatchee Strand and wild ghost orchid pictures: <http://plants.ifas.ufl.edu/fakahat.html> *plus* 16 particularly invasive plants: <http://plants.ifas.ufl.edu/invasive.html> *plus* Pics of 22 north Florida springs: <http://plants.ifas.ufl.edu/springs.html>

Plant Talk is an interesting quarterly magazine with "news and views on plant conservation worldwide". The beautifully designed and illustrated magazine features articles and editorials about the conservation of plants around the world and includes notices and reviews of books and meetings. The subscription price is US\$28 for individuals and US\$68 for institutions. Orders from the Americas: Plant Talk, POB 354841, Palm Coast, FL 32135-4841. Orders from the rest of the world: Plant Talk, POB 500, Kingston upon Thames, Surrey, KT2 5XB, United Kingdom. For more information, contact **Plant Talk** at E-mail: plant-talk@dial.pipex.com

Virtually tour the Indian River Lagoon High quality scans of images of the flora of Spain and Portugal are available on CD from Professor Francisco Perez Raya of the University of Granada in Spain. To see examples of the images of more than 1,000 plant taxa, visit their web site: <http://www.arrakis.es/~jahita> or contact them by E-mail: frperez@platon.ugr.es

You've got to know about FICMNEW. The Federal Interagency Committee for the Management of Noxious and Exotic Weeds is the committee of federal agency employees most interested in noxious, exotic, non-native, non-indigenous (etc.) weeds. View their web site, read the President's Executive Order on Invasive Species, learn about the national invasive species strategy: <http://refuges.fws.gov/FICMNEWFiles/FICMNEWHomePage.html>

More lists, noxious weeds and rare and endangered plants from the Florida Department of Agriculture and Consumer Services (FDACS), along with their associated rules for possession and propagation can be read and downloaded from the FDACS web site: <http://doacs.state.fl.us/~pi/rules.html>

Chaise Hyacinth

Unless you've been on Lake Victoria lately, or here in Florida thirty years ago, it may be difficult to imagine a water hyacinth infestation: floating plants, growing to three feet high, bunched tightly by the wind, upwards of 200 tons of plant mass per acre, covering an *entire* lake or river shore to shore--even large boats can become immobilized. Certainly, fishing and other commerce comes to a halt. On Lake Victoria, more than once water hyacinth has clogged the intake pipes to the power station that supplies Kampala, the capital city of Uganda. No electricity to Kampala. In fact, much of the world's second-largest freshwater lake, which provides fish and accommodates commerce for Tanzania, Kenya and Uganda, is socked in by miles and miles of extra-large "bull" hyacinths.

In the war against water hyacinths, officials have introduced *Neochetina* weevils as biological controls, and have hired a huge grinding machine to break up the gigantic mats. Depending on whom you ask, herbicides may or may not have been employed as well.

Then there's the Water Hyacinth Utilization Project (WHUP), a "sustainable use" project devised to exploit the silver lining of the infestation by using water hyacinths to create jobs. According to Ms. Carolyn Odhiambo, WHUP Coordinator, 60 workers, mostly disadvantaged women, are using the plentiful menace to produce chairs, tables, baskets and shades, paper, books, cards and gift items. WHUP is under the auspices of KICK, a non-governmental organization that aims to develop small enterprises, and is supported by the Department for International Development of Great Britain.

Ms. Odhiambo provided us with photographs of items made from water hyacinth:



Man making furniture from water hyacinth

For more information, contact WHUP and KICK, POB 284, Kisumu, KENYA. kick@net2000ke.com

See the latest big story on water hyacinth in the *Washington Post*, Wednesday, September 22, 1999, page A25.

For a new book on practical uses of water hyacinth, see **Use Water Hyacinth!** under Books/Reports on page 7.



Water hyacinth (*Eichhornia crassipes*)



Chaise lounge

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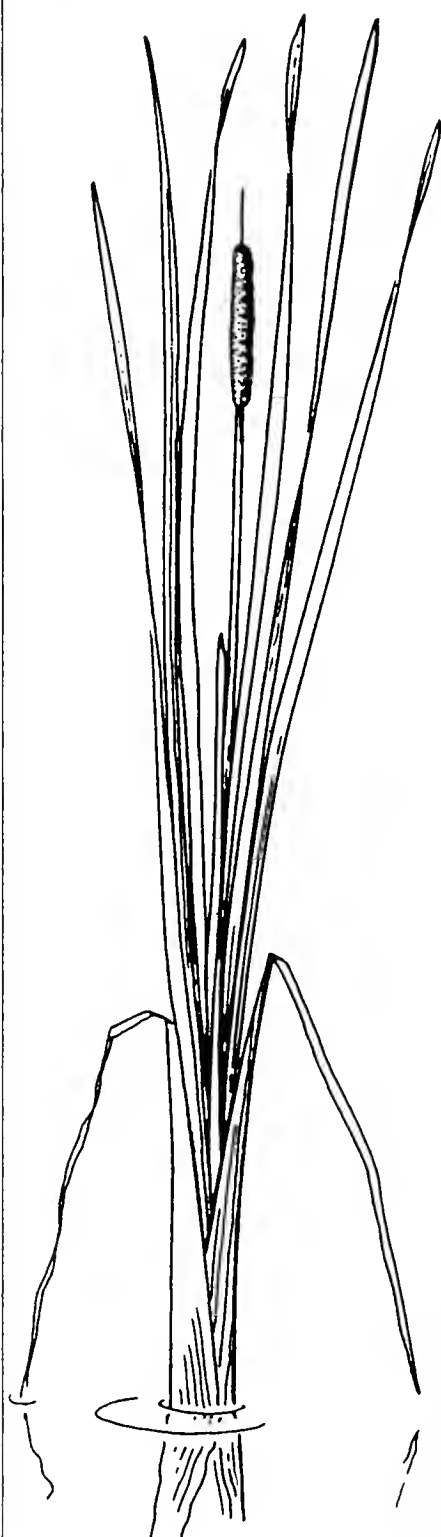
AQUAPHYTE

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AQUAPHYTE is sent to managers, researchers and agencies in 71 countries around the world. Comments, announcements, news items and other information relevant to aquatic plant research are solicited.

Inclusion in *AQUAPHYTE* does not constitute endorsement, nor does exclusion represent criticism, of any item, organization, individual, or institution by the University of Florida.



Plea for a Plant Introduction

In 1882, an appeal was made for the introduction of *Typha latifolia* to Tasmania for the purpose of constructing buoyant life-saving mattresses for use onboard ships. Such devices were being used on Italian vessels at the time. The Victorian Humane Society of Melbourne tested the mattress and found that it could easily support two persons on the water, so they decided to promote the introduction into the colony of the plant those mattresses were stuffed with. Doubt was expressed on the profitability of this introduction since *Typha angustifolia* already occurred on Tasmania. It was remarked that "attention should be first directed to the species to be found naturally in the island." However, it was argued that "The many lamentable disasters at sea and deplorable shipwrecks, which from time to time cause a thrill of horror like an electric shock to pervade the community, demand the adoption of every possible precaution against such dire calamities; and simple as this remedy appears, it may yet be the means of snatching many a valuable human life from otherwise inevitable destruction. If successful, there can be little doubt that but few vessels would be unprovided with them; and thus a possible means of escape from a watery grave would be afforded in many cases of shipwreck on a coast and within a moderate distance of land."

Who could resist such an impassioned plea?!

from the Papers and Proceedings of the Royal Society of Tasmania for 1882, "Economic Value of the Aquatic Plant *Typha latifolia*," by James Barnard.